AIR | ENGINEERING

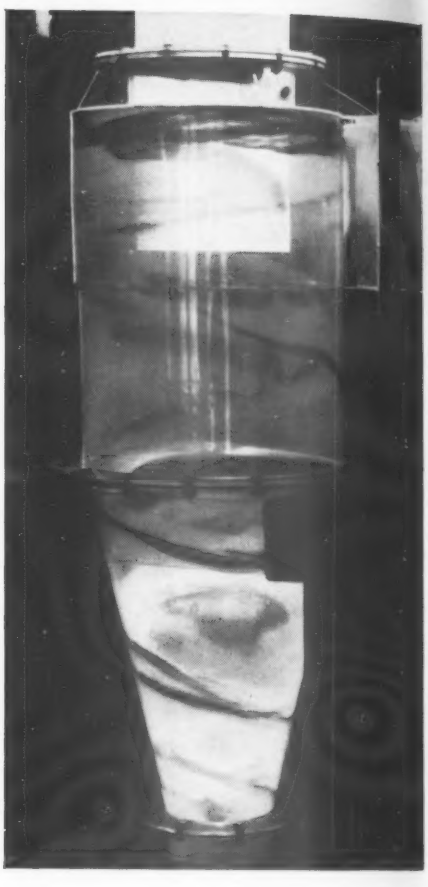
MAY, 1960

THE UNIVERSITY OF MICHIGAN
MAY 9 1960
ENGINEERING LIBRARY

AIR POLLUTION CONTROL • AIR MOVING • AIR CONDITIONING

- *Air Sanitation For Buildings . . . How To Do It*
- *Make-up Air Tips For Industrial Dust Collectors*
- *Low Cost Way To Scrub Incinerator Gases C-l-e-a-n*
- *Instruments And Their Uses For Balancing Air Distribution*
- *HANDLING AIR AT N.Y.'S $500-MILLION-PLUS AIRPORT*

UNRETOUCHED ACTION PHOTOS PROVE SUPERIOR PERFORMANCE OF BUELL CYCLONES



an ordinary cyclone

THE BUELL CYCLONE
with Shave-Off

These are photographs of as true a test as can be made under laboratory conditions. Notice the difference in the dust patterns! In the Buell Cyclone, on the left, the dust at the top makes less than one revolution before it is trapped by the Shave-Off. It's then channeled down to the lower portion of the Cyclone, well below the clean gas outlet.

Why is the Buell Shave-Off so effective? Primarily because it harnesses the double-eddy current to convey the dust "fines" downward quickly, thereby promoting greatly increased efficiencies. In the ordinary cyclone, as shown on the right, these "fines" concentrate and recirculate at the top, causing erosion of the cyclone. To be collected, the fine dust must travel downward close to the clean gas outlet where much of it escapes. Buell Cyclones have made an impressive record in many years of trouble-free service. To see how their extra efficiency in the Shave-Off can pay off for you, send for our Cyclone Catalog #103. The Buell Engineering Co., Inc., 123 William Street, New York 38, New York. Northern Blower Division, 6404 Barberton Avenue, Cleveland, Ohio. (Subsidiary: Ambuco Ltd., London, England.)

buell
Norblo

CYCLONES • ELECTRIC PRECIPITATORS • BAG COLLECTORS • COMBINATION SYSTEMS • FANS • CLASSIFIERS

why buy 5 fans when 1 will do the job?

When you've got a big air moving job to do, use a big fan to do it. Hartzell Low-Speed, High-Volume Fans will handle your big air moving jobs with amazing economy because one of these big fans will do the work of several smaller units.

For example, one 94", 25 H.P. Hartzell Low-Speed, High-Volume Fan will move 174,000 C.F.M. at free air or 157,000 C.F.M. against ¼" static pressure. That's a lot of air... but if it's not enough Hartzell can supply fans in diameters up to 22'. These include all-aluminum assemblies in diameters to 144", glass-plastic fans in 8' and 10' diameters and fabric-base Hartzite plastic fans in sizes from 10' to 22'.

And all of these heavy-duty Hartzell fans are as maintenance-free as fans can be because they're designed and built to stand up under the most demanding industrial applications . . . and thousands of installations prove that they have what it takes.

If you have a big air moving problem . . . or any other problem in industrial ventilation ... it will pay you to get acquainted with your nearby Hartzell field engineer. Drop us a line for his name and address or check the complete list of Hartzell field offices in our catalog in Sweet's Industrial Construction or Plant Engineering Files.

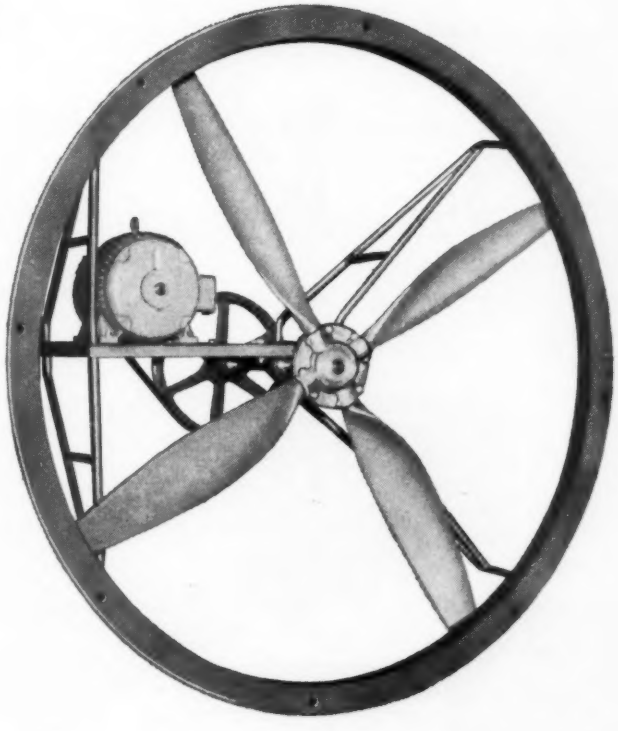


Photo above shows standard construction of Hartzell Low-Noise, High-Volume Fans in sizes from 65" to 94". These fans can also be furnished in direct-connected or pulley-drive (less motor) construction or in belt-drive models with the motor mounted outside the air stream.

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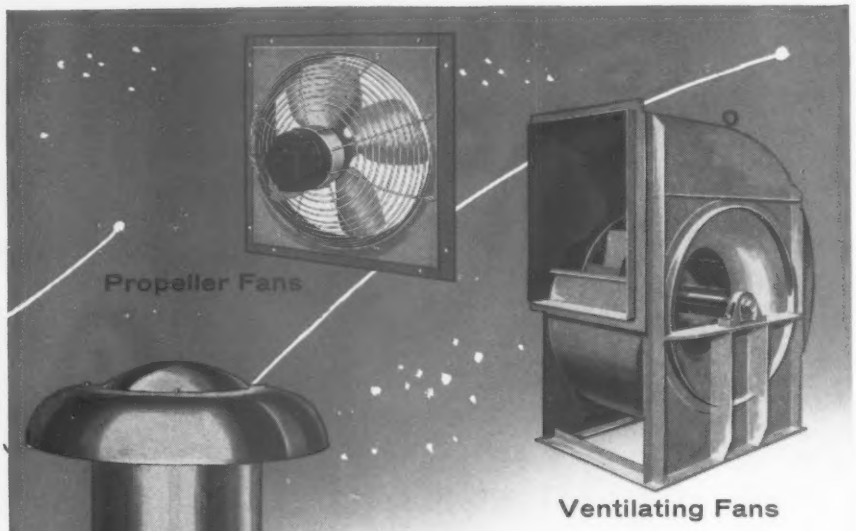
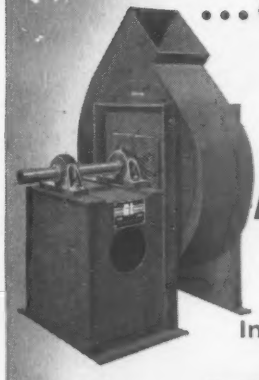
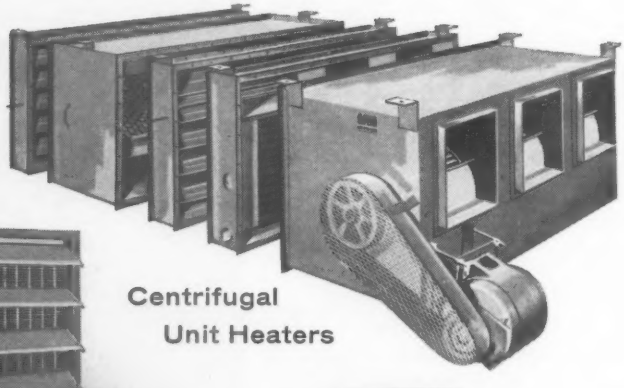
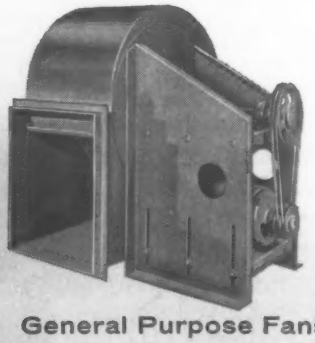
Div. of Castle Hills Corp. A Member of AMCA Engineering Offices in Principal Cities



...a galaxy of products to solve your air handling problems...







nyb

THE NEW YORK BLOWER COMPANY

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Watch For These Articles Next Month!

✓AIR DISTRIBUTION AT IDLEWILD

Five of the seven planned new airline terminal buildings are completed or nearly so. Article describes how each consulting engineer approaches system design in what are different architectural treatments of same usage buildings, with a central source of HTHW and chilled water.

✓HOW TO CONTROL NOISE AND VIBRATION

Sources of noise in air handling systems, with data on how to alleviate and eliminate noise. Article gives 14 ways to end noise, with helpful data on vibration isolation in fan and duct systems.

✓HOW TO VENTILATE DRUM FILLERS

Beginning a monthly series on ventilation in the chemical processing industry. This month we illustrate methods of ventilating drum filling operations which apply to any such process in any plant.

✓RIGHT AND WRONG WAY TO SELECT AND INSTALL FANS AND BLOWERS

With most efficient way to select and install a fan given as $100.00, author shows pictorially what happens to the $100 worth of performance when fan is installed in various ways. An unusually effective way of graphically demonstrating what happens to fan efficiency and performance when fan installation is improper, with an explanation of why and how to correct each "wrong way."

Use Communications Center, page 47, for requesting more information about articles, advertised products, literature, etc.

If you wish to contact manufacturers directly, street addresses are given. But please mention you saw it in AIR ENGINEERING.

AIR ENGINEERING

VOL. 2. NO. 5

MAY, 1960

DEDICATED TO THE SCIENCE OF AIR POLLUTION CONTROL
AIR MOVING • AIR CONDITIONING

FEATURES

Guide To Selection Of Air Cleaning Equipment . . . Part VI 32
Air recirculation . . . make-up air . . . local exhaust ventilation

What You Should Know About Respirators . . . Part III 33
Data on air supplied respirators, uses, applications

Air Pollution Control Association 53rd Annual Meeting 34
List of exhibitors . . . titles of papers to be presented

How To Balance Big Building Air Distribution Systems 36
Problems of balancing low and high velocity systems

Scrubber Solves Incinerator Air Pollution Problem 40
Efficient way to scrub flue-fed incinerator gases

Practical Methods Of Air Sanitation . . . Part II 43
An outline of engineering methods of reducing airborne bacteria

Air Distribution At N.Y.'s Famed Idlewild Airport 49
How new terminal and Port Authority Buildings are air conditioned

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COVER

This view of the absorption refrigeration equipment in the central utility building at New York's famed Idlewild International Airport was supplied by the Carrier Corp., Syracuse, N. Y. See story beginning on page 49 for more details.

AIR ENGINEERING is published monthly by Business News Publishing Company, at 450 West Fort Street, Detroit 26, Michigan. Subscription prices: United States, Canada: $3.00—1 year; $4.50—2 years; $6.00—3 years. Foreign: $5.00—1 year; $8.50—2 years; $12.00—3 years. Single copies 50 cents. Second-class postage paid at Detroit, Michigan. First issue April, 1959. • CHANGE OF ADDRESS. Notify AIR ENGINEERING and your local post-office of both your old and new addresses including postal zone numbers by 12th of preceding month.

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CONDENSE
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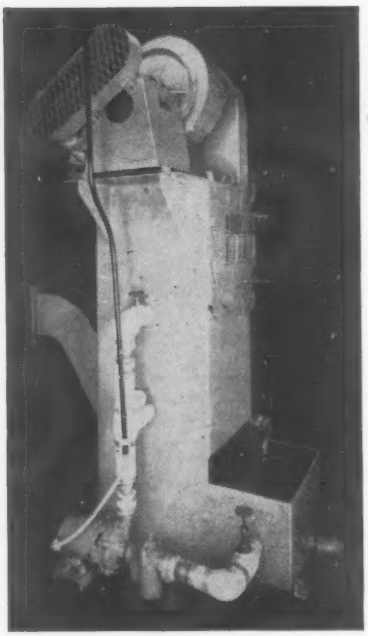

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A Peabody Package Scrubber for gas capacities of 500 to 6,000 c.f.m. can be set in place as a complete package and connected to existing facilities. The unit includes the scrubber, recycle pump, recycle tank complete with piping and valves, exhaust fan and motor. For flue-fed incinerators a fixed automatic by-pass to atmosphere prevents blow-back through furnace and charging doors.

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- **remove dust from material handling, screening and crushing operations**
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- **clean incinerator gas of smoke, dust and some toxic materials**
- **clean air of metallic dust from lathes, grinders, millers and shapers in machining operations**
- **remove dust and condense solvent vapors leaving rotary and spray dryers**

Write today for complete information on these efficient package units and your copy of the new Peabody Scrubber Bulletin 203-C!

O-085

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Letters

More On Ink Mist

Editor:

I have read with much interest the report on "Printing Ink Mist—How to Stop It" by V. N. Federoff of Carrier Corp. appearing in your Feb. issue and while I find no fault with the measures taken to combat it, I am wondering whether more basic preventive measures have been tried.

What I have in mind is a preheating of the web for the purpose of reducing the ink viscosity and tack while increasing the receptivity for the ink by the paper at the time and point of separation of the web from the printing form. Under such an arrangement and with press room temperature control, inks of higher initial viscosity and tack could be used and thus eliminate much of the trouble originating from the ink rollers and press cylinders, not to mention possible ink economies.

High intensity instantaneous linear type of electrical radiant heaters are now available for the foregoing application and tests on both sheet fed and web equipment indicate the value of the suggested approach, which of course on web work need not be limited to the use of radiant heat.

Hector Audino
Consultant
Ridgefield, N. J.

Editor:

As this is the first time I have written you, I should like to commend you for a very interesting format in your AIR ENGINEERING magazine.

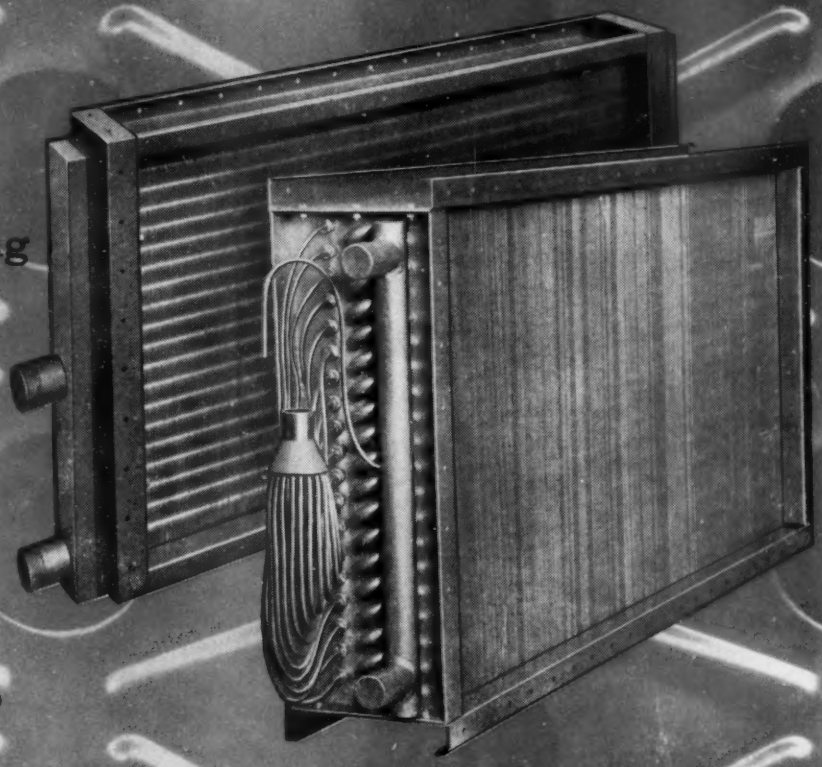
I found the article by Mr. V. N. Fedoroff on control of ink mist in your February issue a most interesting one. The author is quite correct in stressing the need for effective air filtration in pressroom exhaust systems, and our wide experience in this field corroborates much of what he states. We have used the Farr Type 68 panel type,

(Please turn to page 8)

Use Communications Center, page 47, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

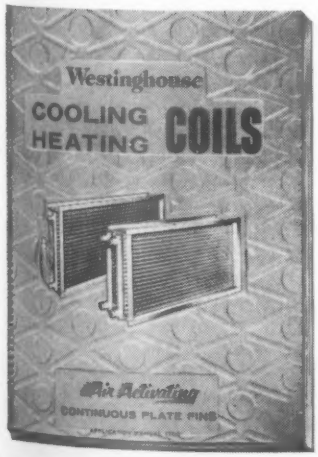
When you need heating and cooling coils...

these are better



because of this!

Air Activating Guides



And more prime surface than any other coil!

Now! New Application Manual with complete data for consulting and designing engineers prepared in the format recommended by the Committee of 100 Prominent Consulting Engineers.

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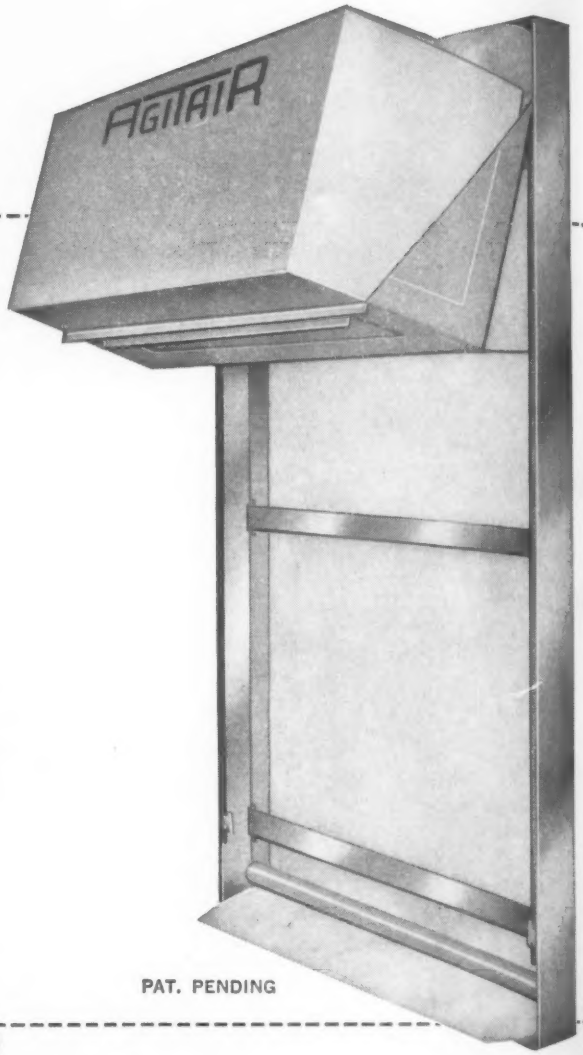
AGITAIR®

TYPE "DS"



PAT. PENDING

AGITAIR Type DS Pull-Down filters are engineered to assure the user high dust holding capacity . . . uniform filtering efficiency over the active length of the media with a savings in installation and maintenance costs.

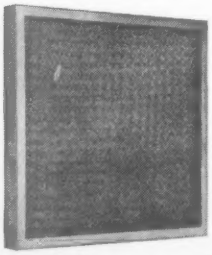
Manually operated, the Type DS eliminates the use of any motors and controls . . . has no moving parts to get out of order . . . easy to install . . . simple to service.

AGITAIR Type DS Pull-Down filters are available in a variety of sizes and capacities to meet your air filtration requirements. For complete data on these units, ask your AGITAIR representative for technical catalog DS-100 or write direct to Air Devices Inc.

ALSO AGITAIR PANEL FILTERS

HIGH VELOCITY
TYPE "FM"

Permanent, cleanable all metal construction. Large dust holding capacity and low resistance. Recommended velocity 533 fpm. Made in 1", 2", 4" thickness. Catalog available.



LOW VELOCITY
TYPE "AP"

Permanent, cleanable all metal construction. Effective filtration – low resistance. Recommended velocity 350 fpm. Made in 1", 2", 4" thickness. Catalog available.

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high velocity units . . . air diffusers . . .
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EDITORIAL:

The Lady or the Tiger?

GENERATION ago the American reading public was titillated by Frank Stockton's arresting short story, *"The Lady or the Tiger?"*

All over the nation readers choked on their Adam's Apples while Our Hero escaped from one oriental cliff-hanging hazard after another. He was confronted, in the end, with a potentate's dictum:

Horrible clawing death, or happiness forever with a beautiful princess. Get this picture: behind one door is the sexy gal; behind the other is a ravenous man-eating tiger. Our Hero chooses, enters, and . . . the author doesn't reveal what happened. Which, *Which*, WHICH?

Such dilemmas are not without counterparts in modern business life. Herewith we present, in fable form, a true story.

Once upon a time a new chemical compound was introduced into a manufacturing process. Shortly afterward several workers became ill, and had to be hospitalized—with subsequent loss of income, and much hardship on the individual families involved.

Eventually, through leg work and hard thinking, this factory's Air Engineer traced the source of their illness back to toxic fumes which were released by the aforesaid chemical, into plant air.

Promptly this valiant fellow designed a hooded ventilation exhaust system, along with a scrubber, which removed these harmful gases. Illnesses from this cause promptly ceased in that factory.

Wonderful! Our Hero, the Air Engineer, was conscientious. He realized that there must be many hundreds of other workers, in other plants, who similarly were being exposed to this same chemical compound and to its toxic fumes.

Thereupon he wrote an article which detailed what happened in his plant, and how he had solved this problem. Being a good Organization Man, he forwarded this article to Public Relations Headquarters in the front office.

After the Public Relations people were pulled down off the ceiling, the article was passed to the company's attorney. Distressed was the latter at the prospect of lawsuits arising from claims against the company due to exposure of employees to a toxic fume.

Result: the public relations director, the attorney and the President converged on this discoverer . . .

(Please turn to following page)

Editorial (Cont.)

The Lady or the Tiger?

(Continued from preceding page)

did he want to put the company out of business? . . . didn't he have enough sense to realize that the company would be sued for many thousands of dollars? . . . and in all probability would lose the suits?

Thinking quickly, this Air Engineer suggested that the company's name be deleted, and his signature, too. Anonymously his findings could be offered to a "neutral" magazine simply as a description of a public health hazard and how it could be solved.

The public relations man, to do him credit, felt that this might be a worthy endeavor.

The attorney, however, persuaded the President that such forthright action might in some way be traced back to his plant. Even if it weren't, the fact that a description of this foul-up might be jumped upon by some smart union industrial hygienist gave all of them the cold shudders and heeby-jeebies.

Clearly our Air Engineer faced a moral issue. He owed loyalty to his company, he owed security to his family, and he owed to Society-at-Large his revelation of how to prevent illness and ultimate tragedy.

Which is greater? His duty to People Everywhere, or dedication to his family and employer?

Point of this editorial: harmful secrecy of the type described in this Parable of the Perplexed Air Engineer is shortsighted, and incompatible with the best interests of American industry.

It is up to each and every Air Engineer to live with his own conscience. The Lady or the Tiger? ▲▲

Letters

(Continued from page 4)

permanent filter very successfully in the removal of ink mist from pressroom exhaust air. Application of an air filtration system of this type has many advantages.

1. Lower pressure drop, at high efficiency.

2. By using this type of filter it is possible to place the filter closer to the source of ink mist generation, thus reducing the conveying distance.

3. There is no possibility of the filter media breaking due to over saturation of ink, with use of this filter.

In pressroom exhaust systems using the filter, the discharge ductwork is spotless, attesting to its high efficiency. Many newspaper and printing establishments are satisfied owners of this filter.

Max Share
Farr Filter Co.
Brookline, Mass.
(Regional Office)

Wants To Frame Front Cover

Editor:

We have just seen the front cover of the March, 1960 issue of AIR ENGINEERING, which we understand is from a painting supplied by Minnesota Mining & Manufacturing Co. We wonder if there are any reproductions suitable for framing available?

Charles MacIntosh
MacIntosh and MacIntosh
Consulting Engineers
Los Angeles, Calif.

* * *

Editor's Note:

We regret that the high cost of four color process printing forbids any larger size cover artwork than that of the front cover itself. We have a very limited supply of front covers from any particular issue, and can send these for cropping and framing to any who wish to frame them.

Wants Gold Mine Data

Editor:

Please forward additional information on dust removal from Hollinger Gold Mines, Ltd., by J. R. Hall, appearing in the August, 1959 issue.

J. S. Coogan
Assistant Supervisor
Reynolds Electric and
Engineering Co., Inc.
Las Vegas, Nevada

* * *

Editor's Note:

We have had several other requests for this data. Additional information may be obtained by writing to the Mines Accident Prevention Association of Ontario, 320 Bay St., Toronto, Ontario, Canada.

Use Communications Center, page 47, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

Editor:

We would appreciate your keeping us posted on your publication and its Canadian development. We have heard good reports on your editorial content to date.

R. M. Quarry
Burlington, Ontario

Likes "White Room" Story

Editor:

Please send me article on Dust-free Air For Gyroscopes, from p. 40, May 1959 issue.

Ervin A. Latus
Mechanical Engineer
AC Spark Plug
Milwaukee, Wis.

Editor:

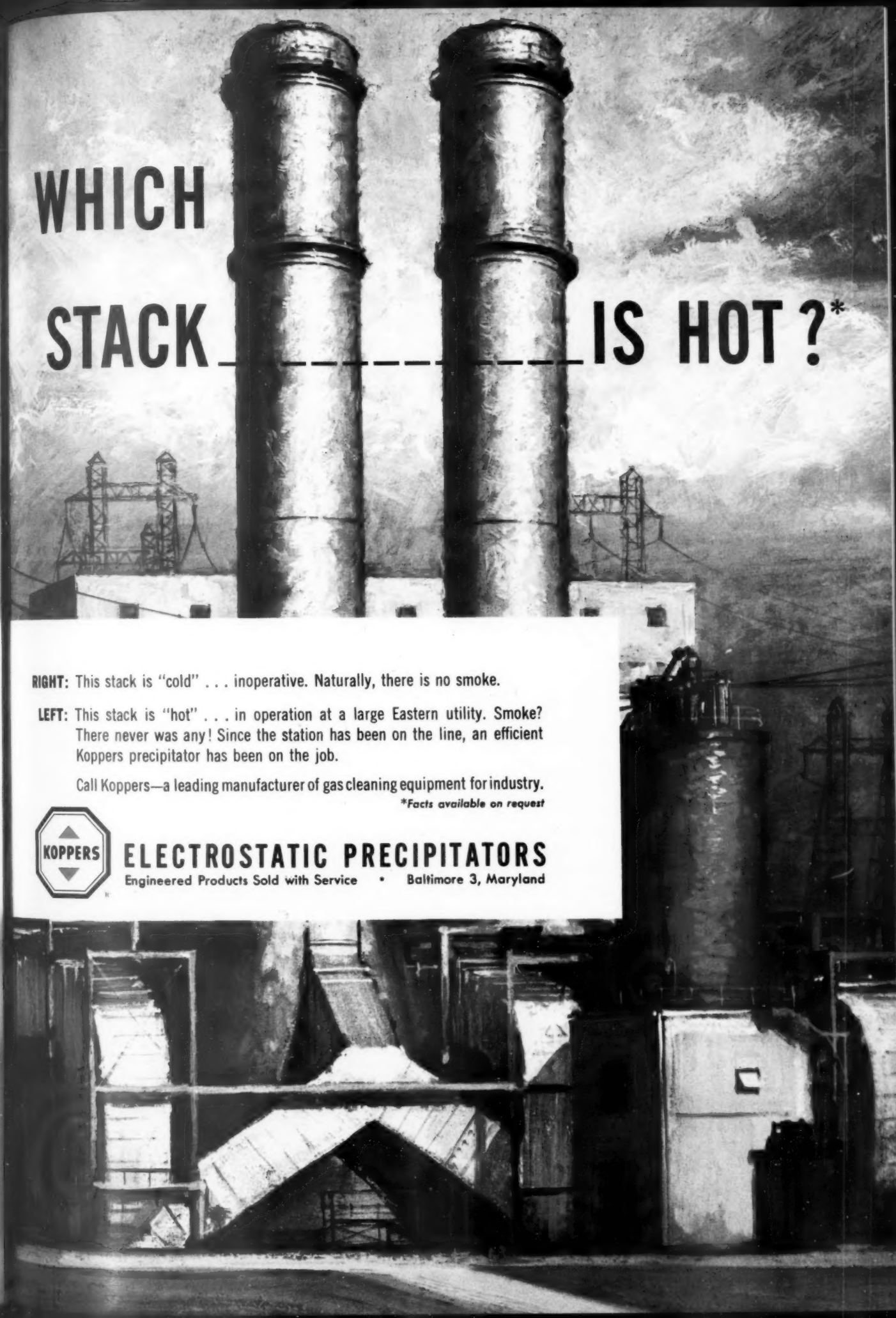
Please advise us as to how we may obtain reprints of articles in your magazine.

The specific articles right now are:

1. "Caps for Exhaust Hoods," August, 1959 issue.

2. "Gas vs. Electricity As A Fuel," January, 1960 issue.

B. W. Taylor
Plant Engineering Department
McKinnon Industries, Ltd.
General Motors Corp.
St. Catherines, Ont.


WHICH
STACK _____ IS HOT?*
RIGHT: This stack is "cold" . . . inoperative. Naturally, there is no smoke.
LEFT: This stack is "hot" . . . in operation at a large Eastern utility. Smoke? There never was any! Since the station has been on the line, an efficient Koppers precipitator has been on the job.
Call Koppers—a leading manufacturer of gas cleaning equipment for industry.
*Facts available on request
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ELECTROSTATIC PRECIPITATORS
Engineered Products Sold with Service • Baltimore 3, Maryland

Survey Of Russian Air Pollution Literature Underway

A survey of U.S.S.R. literature on air pollution and related occupational diseases is being conducted by Dr. Ben S. Levine under a U.S. Public Health research grant. First volume in the survey has been released by Office of Technical Services, Business and Defense Services Administration, U.S. Dep't. of Commerce, (Order OTS-60-21049, $3.50).

BCI Reports Sulfur Removal From Bituminous Coals

Results leading toward probable reduction of sulfur in bituminous coals have been achieved by Bituminous Coal Research, Inc., during research co-sponsored by electric utilities and coal industries.

Working with five high-sulfur bituminous coals from different areas, BCI has been able to liberate substantial pyritic sulfur from the coal. Research is to be done to make this process feasible on a large scale.

Charges Industry Conceals Facts On Occupational Health Hazards

Major industries distort and conceal facts on occupational health hazards, according to Dr. William C. Hueper, chief, environmental cancer section, National Cancer Institute. Some government agencies aid in the distortion, he also charged during a science reporters seminar conducted by the American Cancer Society in Louisville, Ky.

As long ago as 1929, Hueper said, he found evidence that certain chemicals used in the dye and rubber industries caused cancer of the bladder. He was prevented from presenting a paper on the subject, he stated, before an International Cancer Congress, by the medical director of an American chemical company.

Battelle Starts Research On New Ways To Cool AF Electronic Gear

A one-year study has been authorized by the Air Research and Development Command to search out cooling systems that may improve over-all effectiveness of ground-based Air Force electronic equipment.

Study, to be conducted by Battelle Memorial Institute, Columbus, Ohio, will investigate high speed centrifugal compressors, Peltier cooling units, and the Stirling and azeotropic cycles. One goal will be to conceive new cooling techniques for more efficient, lighter and smaller refrigeration systems for equipment such as the compact, mobile units used to control and track aircraft.

Study Accuses Hospitals Of Poisoning Surrounding Community

Evidence has been unearthed that infectious drug-resistant strains of Staphylococcus Aureus spread from their breeding places in hospitals to the community-at-large.

A report in a recent issue of Science also indicates that animals may carry these staph infections to humans.

Finds are based on investigation of epidemic staph infections among students at University of Pennsylvania Veterinary School which persisted for two years, and spread to students' families.

Report was made by Wistar Institute and Department of Research Medicine of University of Pennsylvania; Communicable Disease Center of the U.S.P.H.S and Pennsylvania Department of Health.

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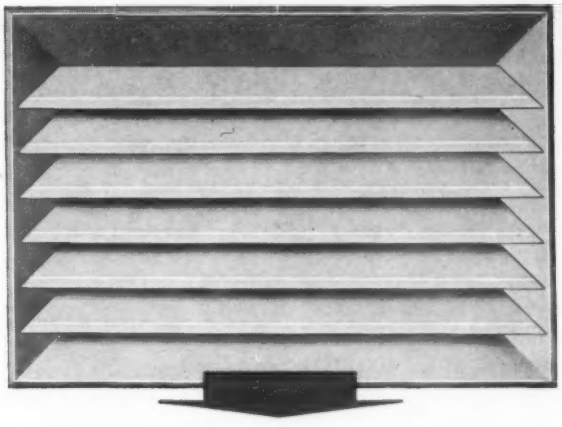

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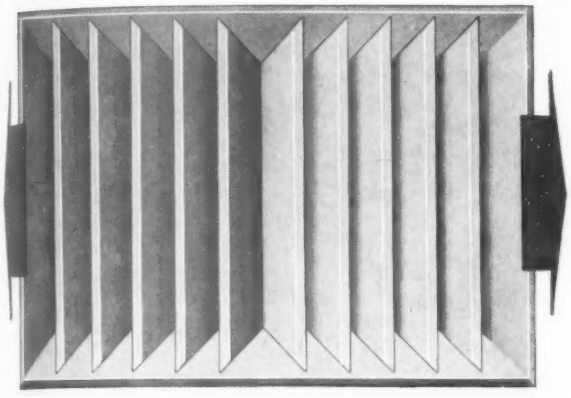
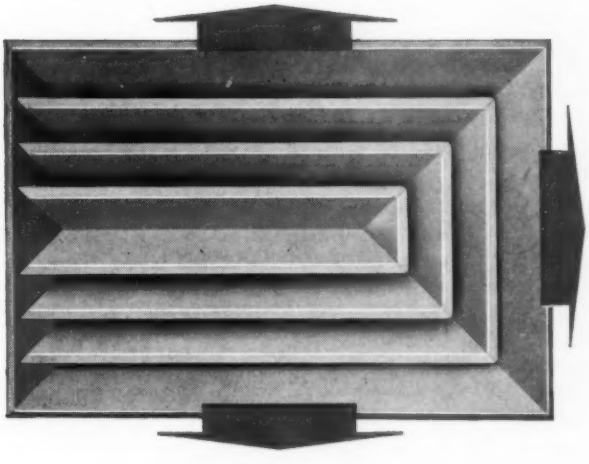
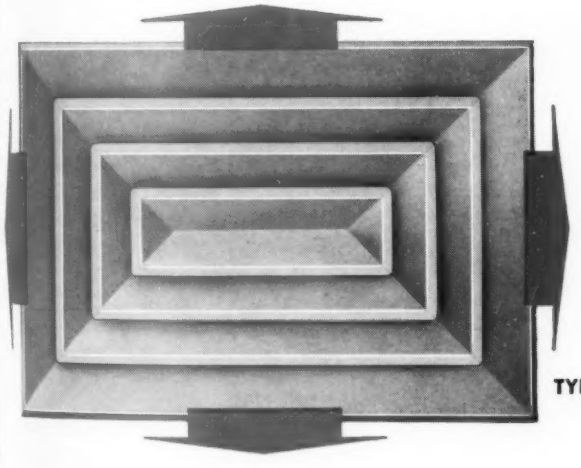




TYPE M 3-WAY BLOW



TYPE M 4-WAY BLOW

Ideal conditions for the placement of ceiling diffusers do not always exist. Walls, partitions, exposed beams, supporting columns, light fixtures . . . big offices, small offices, corridors . . . are some of the factors that can contribute to the problem of correctly selecting and locating air distribution outlets.

With Tuttle & Bailey Type M Diffusers . . . you can select units that will distribute air in a one-, two-, three-, or four-way pattern . . . and you can select from a wide range of square and rectangular sizes. An added advantage . . . if and when requirements change in the conditioned space, it is an easy matter to install a core with a different air pattern arrangement.

T & B Type M Diffusers are attractively styled and can be furnished with four margin styles . . . beveled, flat, flush, or drop-collar . . . designed for various types of ceiling mountings.

For complete details, see your nearest Tuttle & Bailey Representative or write us direct.

TUTTLE & BAILEY

division of Allied Thermal Corp. New Britain, Connecticut

Tuttle & Bailey Pacific, Incorporated, City of Industry, California

NEWS of the Industry

California Approves Exhaust Control Device on Autos

California state legislature has approved a bill which will require installation of exhaust control devices on all new cars sold in California within one year after such devices become available.

The measure also would require installation of the devices on all used vehicles within three years unless they specifically are exempted by local boards of supervisors.

Because of a $500,000 appropriation in the bill, it must be referred to the State Senate finance committee for screening.

The measure calls for a 13-member motor vehicle pollution control board within the State Department of Public Health. The board will issue certificates of approval for devices which meet the standards of air established by the department.

Once two exhaust control devices are certified as approved, the mandatory installation provision of the bill will become effective. Testing of the devices would be done under contract with public or private agencies equipped to handle them.

Smith Griswold, Los Angeles County Air Pollution Control District chief, predicted exhaust devices will be available within a year of the date that the measure becomes effective.

He estimated there are about 20 such devices in various stages of completion that could prove satisfactory and which would retail in the neighborhood of $60 to $70 apiece for lower-cost automobile models.

Bradley Opens Office

Opening of new offices and laboratories at 18 Green St., Newark, N. J. has been announced by William R. Bradley, former assistant director of environmental health at American Cyanamid Co.

Bradley will do consulting engineering on environmental health, including air pollution.

How Ductwork Was Fabricated For Oakland's Kaiser Center

Unusual methods have gone into the fabricating of ductwork for the 28-story Kaiser Center building in Oakland, Calif. The air handling system for the structure, said to be the largest office building west of Chicago, uses approximately 300,000 lbs. of aluminum duct sheet.

Fabrication has been done by the Scott Co. of Oakland. Scott's plant superintendent F. C. Bushell says of the fabricating methods used:

"We had to join and install unusually large sections—up to 63 in. in diameter. For joining longitudinal and perimeter sections, we devised special jigs — boom-like units with two arms. The top arm is the track for the welding machine and the bottom arm is the holding fixture.

"The holding fixture consists of a steel pipe with a copper strip on top. Rolled aluminum sheet—flanged and open at the seam—is placed around the fixture, with the seam resting on the copper. The seam is closed by fusing; no filler material is required.

"As the Heliarc (tungsten inert gas) welder runs along the track and fuses the seam, water is pumped through the steel pipe to cool the copper bar. With a setup like this, the seam can be fused at 80 in. a minute."

The setup for perimeter welding is similar, except that the holding fixture has angle irons that are extended by compressed air until they meet the sides of the duct. These arms can extend from 6 to 63 in. diameter. Three 4-ft. sections of round duct are fused to form a 12-ft. section.

Scott Co. also has made special provision for joining these 12-ft. sections. A roller stretches the ends about 1¾ in. to allow for a field joint. This joint is filled with tough bond cement and taped with Arno tape, a plastic-coated cotton base tape that has aluminum backing. Sheet metal screws are put in to further strengthen the joint.

Rensselaer Offers Environmental Engineering Degree

Rensselaer Polytechnic Institute, Troy, N. Y., has, after three years of study by a campus wide faculty committee, established a new four-year curriculum leading to the degrees of Bachelor of Science in Environmental Engineering and Master of Science in Environmental Engineering.

The new curriculum is designed to prepare students for careers in the scientific and engineering aspects of environmental control—including air pollution—and the effective utilization and conservation of natural resources.

Besides air pollution, training is given in radiological health, water supply, food supply, land use and housing, and wastes.

According to Prof. E. J. Kilcawley, head of the division of environmental engineering, the curriculum differs from conventional programs in this field in that more emphasis is placed on mathematics and the fundamental sciences and a wide range of electives is offered.

This results in a relatively high degree of training in one of several specialized areas at the undergraduate level and prepares the student to pursue graduate study more effectively, he added.

Regulation 2 Moves To Next Plateau

The San Francisco Bay Area Air Pollution Control District's Advisory Council has accepted and approved the final draft on proposed Regulation 2 (designed to control emissions from industrial, incineration, materials handling, and heating and power generation operations).

Public hearings on the proposed regulation were tentatively set for late April. Based on the current draft, after Regulation 2 is adopted, affected industrial operations must register within 60 days.

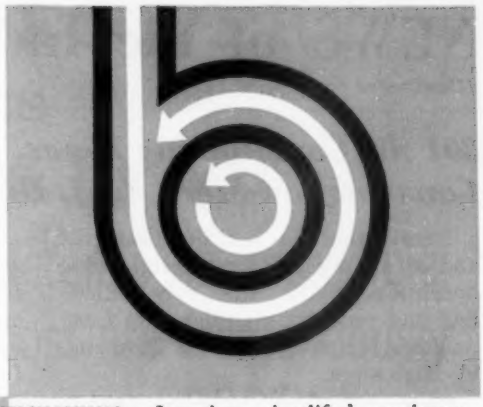
(Please turn to page 18)

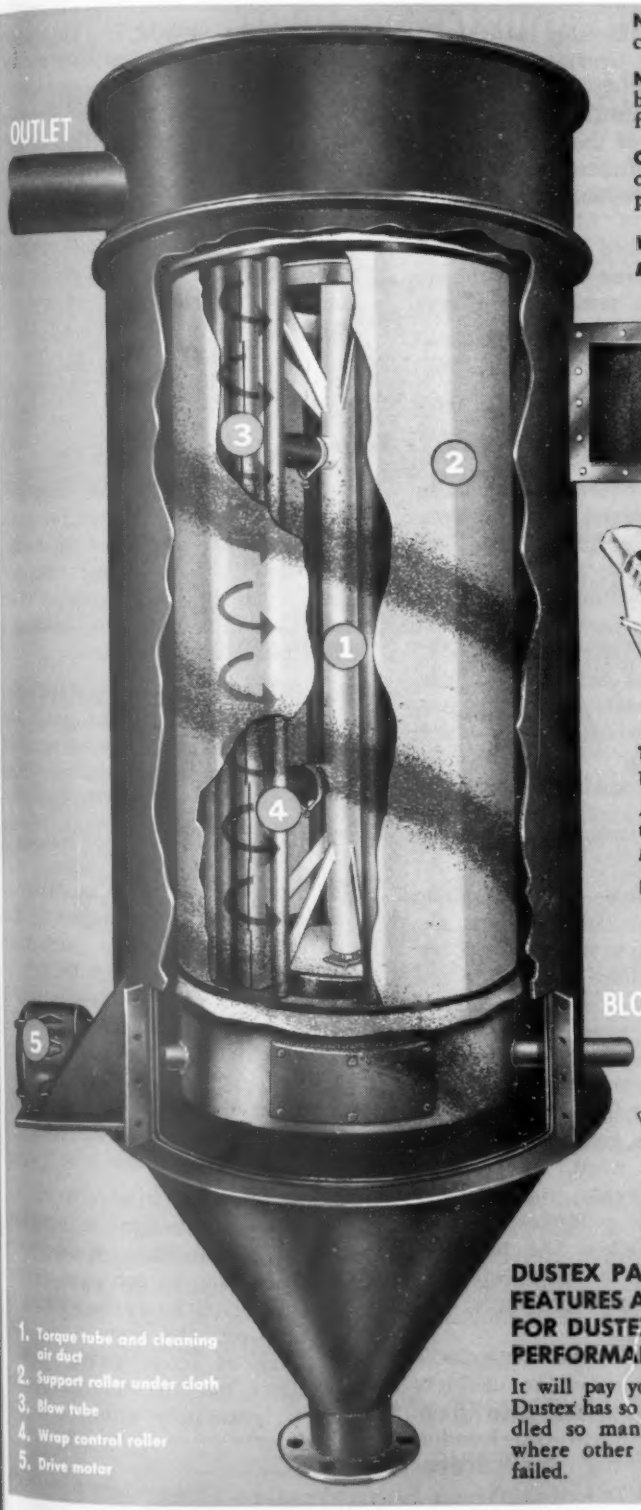
From Dustex . . .

another revolution in dust collection . . .

DUSTEX ROTO-JET CLOTH COLLECTOR

where cloth is the RIGHT answer . . .
Dustex engineering eliminates usual cloth problems
drastically lowers operating and maintenance costs





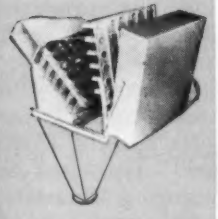
1. Torque tube and cleaning air duct
2. Support roller under cloth
3. Blow tube
4. Wrap control roller
5. Drive motor

NO REVERSING MECHANISMS — Ingenious, simplified, continuous cleaning action *in operation.*

NO CLOTH JAMMING — Unique controlled wrap of cloth around blow tube eliminates cloth jamming . . . maintains constant, low friction that requires less driving torque and power.

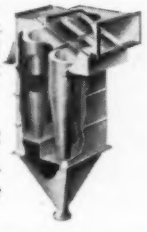
CLOTH CHANGES EASIER . . . LESS FREQUENT — Dustex Roto-Jet principle keeps cloth cleaner during operation. Gentle, free roller action prolongs cloth life. Easy access simplifies changes when required.

WHERE CENTRIFUGAL COLLECTION IS THE RIGHT ANSWER
DUSTEX PATENTED FEATURES PAY FOR THEMSELVES



DUSTEX MINIATURE CYCLONES
D-584 with 100% efficiency at 14 microns
D-560 with 100% efficiency at 12 microns
for economical separation of dust from normal or high temperature gas or air.

MICROCLONE with 99.8% efficiency at 10 microns and smaller for ultra-high efficiency and strict sanitation . . . easily cleaned and sanitized thanks to convenient hinged top tube sheet design.



For Many Ordinary Dusts New, Low-Cost DUSTEX "1600" brings higher Dustex Performance to collectors in Lower Price Range.

THE BIG DIFFERENCE — DUSTEX EXCLUSIVE PATENTED DESIGN

Unobstructed inlet plenum avoids material buildup and plugging.

All tubes are surrounded by cleaned gases and maintained at system temperature to forestall condensation and plugging when systems gases are above dew point.

FOR ALL HOPPER AND BIN DISCHARGES (Under Negative Pressure)

DUSTEX VACUUM VALVE—No motive power required . . . No mechanical parts . . . Maintenance free . . . Bolt in place and forget it.

ON THE JOB DETERMINATION TEST YOUR BEST GUARANTEE

The Dustex Single Tube Determination Test, performed under your actual operation conditions, provides you with exact data required to select the proper Dustex Collector for your plant. No cost or obligation.

SEND FOR "A Simplified Test Method," illustrated booklet describing the Dustex Single Tube Determination Test in detail.

Details and specifications for every model available on request.

DUSTEX PATENTED FEATURES ARE THE BASIS FOR DUSTEX SUPERIOR PERFORMANCE

It will pay you to learn why Dustex has so successfully handled so many process dusts where other collectors have failed.

dustex CORP.

The company with the big name in dust collection

DUSTEX CORP. • P.O. Box 2520 • Buffalo 25, N. Y.

NEWS of the Industry . . .

(Continued from page 14)

301 Air Conditioning Zones, Lift-Slab Construction Mark Calif. Highways Bldg.

Innovations in building design, and in air conditioning design and operation, mark the new office building recently completed in Los Angeles for the California Division of Highways.

The new structure is of "Lift-Slab" construction with tinted glass, curtain-wall skin. It has 301 air conditioning zones.

Air is supplied at high velocity to Barber-Colman CVO constant volume mixing boxes serving all 301 zones. These mixing boxes temper zone supply air, maintain required air volume regardless of static pressure changes within specified limits, and attenuate fan noises so as to maintain quiet office areas.

Cooling is supplied by two Trane 350-ton CenTraVac units. Two Cleaver-Brooks boilers are used as the heating media.

The entire air conditioning system for the new building, as well as the smaller existing office building, is controlled by a schematic control center located in an office of the new building.

All graphic illustrations depicting the many fan, refrigeration, heating, and air conditioning systems employed throughout the buildings are printed by a silk-screen process on a gold anodized aluminum panel.

Thus, control and remote operation of 14 separate mechanical equipment rooms is centralized in one location.

Incorporated into the master schematic control panel are these features: time switches automatically pilot the operation of equipment in both buildings; the supply fans of each system are started in sequence through a program switch to reduce the starting load; automatic switches override the automatic control to start and stop any supply or exhaust fan or the refrigeration system of the new building; pilot lights indicate operation of each of the previously mentioned items and also all pumps and compressors; and hot and cold deck temperatures of the eight fan systems can be remotely adjusted from the panel.

Dr. Chambers Moves to USC

Director of Research for the Los Angeles County Air Pollution Control District since 1956, Dr. Leslie Chambers leaves this post April 29 to accept the position of Scientific Director of the Allan Hancock Foundation at the University of Southern California.

Air Pollution Control Officer Smith Griswold said that there will be no replacement of Dr. Chambers until there has been a review and reappraisal of the Control District's research program and its objectives.

Crane Acquisitions Draw FTC Fire

The Federal Trade Commission has charged that the Crane Co. has violated the antitrust laws by acquiring all or part of the stock or assets of the following five companies within the past two years: Chapman Valve Mfg. Co., Briggs Mfg. Co., National-U.S. Radiator Corp., Swartwout Co., Inc., and Pipe Fabricators, Inc.

The FTC's complaint alleges the acquisitions violate the antimerger law, Section 7 of the Clayton Act, because their effect, individually and collectively, may be substantially to lessen competition or tend to create a monopoly.

Wesley A. Songer, Crane Co. president, expressed himself as being "surprised and amazed by the complaint" and said he did not "see how Crane Co. is in violation of any Federal laws."

Dr. Irwin Offers Theory on How Airborne Pollution May Produce Toxic Effects

A theory of how airborne pollution has produced toxic effects under certain circumstances was outlined by Dr. D. A. Irwin, medical director, Aluminum Co. of America, in a paper "Air Pollution —Its Effects, Control, and Abatement" presented before the Manufacturing Chemists' Association.

Dr. Irwin described the toxic result as arising from the "synergistic effect" growing out of the relationship of irritant gases and particulates when combined. In his paper he stated:

"Water soluble irritant gases and vapors are removed in the upper respiratory tract. However, if to an atmosphere containing one of these gases a fine, inert particulate is added, immediately there is evidence of systemic adsorption of the gas into the blood with the production of lesions of the terminal air passages and air sacs.

"Apparently what happens is that the gas or the vapor is adsorbed on the particles and is liberated only when the particles are deposited on the moist surfaces of the respiratory passages and lungs.

"Moreover, it seems reasonable to assume that moisture droplets may act similarly, and may have played some part in the London episodes where fog was particularly prominent.

"The irritant gas may conjugate chemically with tissue elements which, in turn, can produce marked pulmonary and systemic reactions. The irritant may gain direct entry into the blood stream, causing a systemic toxic response.

"With this new understanding of the relation of irritant gases and particulates—of their synergistic effects when combined—we have added new complexity to the problem of establishing standards for community air pollution.

"Thus, an industry contributing only entirely inert, non-toxic fine micron or submicron particulate matter to the air may be just as responsible for the adverse health effects—acute illness and death—in an acute episode of community air pollution as the industry contributing small amounts of a toxic gas, vapor, or mist, although singly these materials would cause no adverse effects.

"Therefore, in light of our present understanding, it behooves every industry to consider seriously all contributions it is making to pollution of the community air, not only of toxic gases, vapors, and mists, but also fine particulate matter, especially submicron particulates."

(Please turn to page 18)

HOW DOREX AIR RECOVERY annually cuts air conditioning costs by 78%

Over a 20-year period, the dollar difference is incredible, the penalties of owning and operating cost are tremendously reduced . . . if an air conditioning system uses DOREX to recover already conditioned air rather than use 100% outside air.

DOREX is designed in two basic types—C Cells and H Canisters. Because of their arrangement flexibility, canisters are especially suitable where installation space is limited or irregular.

ESTIMATED DIFFERENTIAL OF OWNING AND OPERATING COSTS, OUTDOOR AIR vs RECOVERY AIR FOR 1000 CFM

ITEM		OUTDOOR AIR	RECOVERY AIR
	ANNUAL FIXED CHARGES		
1.	Amortization, 20 years, cost per year	$ 78.10	$ 17.50
2.	Interest rate, 4 percent [(20 yr + 1)/(2 × 20 yr)] × 0.04 × initial cost	32.00	7.35
3.	Taxes and insurance (neglected)	0.00	0.00
4.	Total annual fixed charges	110.10	24.85
	ANNUAL MAINTENANCE COSTS		
5.	Repairs, refrigerating equipment $1.20 per ton	4.56	
6.	Refrigerant 0.44 per ton	1.67	
7.	Oil and grease 0.12 per ton	0.46	
8.	Repairs, heating gross	5.00	
		11.69	
	ANNUAL SERVICE COSTS		
9.	Electric power, refrigeration (0.746 × hp × cooling hours)e* = 3220 kwhr		
10.	Cost of electric power 1.5¢ per kwhr		
11.	Refrigeration power costs (Items 9 and 10)	48.20	
12.	Water at 11 cents per 1000 gal (neglected with cooling tower)		
13.	Heat requirement 4.5 × 1000 × 11.7** × 2200/e* = 165,000MBtu		
14.	Gas cost, $1.00 million Btu		
15.	Heating cost (Items 13 and 14)	165.00	
16.	Recovery fan power, 0.0001573 × 1000 head = 0.063 hp		
17.	Recovery fan power, [0.746(16) (2200 + 810)]/e = 188 kwhr		
18.	Recovery fan power costs (Items 10 and 17)		2.82
19.	Labor to change recovery cells		2.00
20.	Freight to ship used and recharged units		10.00
21.	Regenerate, recover cells		35.00
		213.20	49.82
	SUMMARY		
	Annual fixed charges	110.10	24.85
	Annual maintenance costs	11.69	
	Annual service costs	213.20	49.82
	Total annual owning and operating costs	334.00	74.67
	Annual savings with air recovery		260.32
		334.99	334.99

*Efficiencies are taken in items 9 and 13 as 70 and 75 percent respectively.
**Difference in enthalpy, Btu per lb of dry air, between inside and outside, for average winter conditions.
From a paper by Warren Viessman, Heating, Piping & Air Conditioning—Sept. 1959

By recovering used, already conditioned air, extracting from it the accumulated impurities, and converting it to original freshness, DOREX brings about maximum economy in air conditioning. Detailed information on the unique DOREX process and equipment is available. Simply request—on your letterhead, please—Bulletin 108A and "Air Conservation Engineering". Contact the representative near you or write to Connor direct.

CONNOR ENGINEERING CORPORATION

DANBURY • CONNECTICUT

CONNOR ENGINEERING CORPORATION dorex® air recovery

. . . the most experienced professionals in air recovery and purification.

NEWS of the Industry...

(Continued from page 16)

ISA San Francisco Conference May 9-12 To Review L. A. Air Monitoring Systems

Existing air monitoring systems and instruments used by the Los Angeles County Air Pollution Control District and a review of operating experience with automatic monitoring instruments, will be described by engineers of the District at the Summer Instrument-Automation Conference & Exhibit of the Instrument Society of America, to be held May 9-12 in San Francisco.

Report of the Control District engineers will be included in one of 10 technical papers to be presented during two sessions on Air Pollution Instrumentation.

The sessions, prepared by ISA's Analysis Instrumentation Div. have been developed by Dr. D. F. Adams, head of the Air Pollution Research Department, Washington State university.

Other papers deal with newly developed instruments for detection and measurement of hydrocarbons in both trace and percentage quantities; the continuous analysis of atmospheric ozone; and several newly developed detectors and recorders.

The Air Pollution Instrumentation sessions will be held on Wednesday, May 11, and Thursday, May 12.

Pall Doubles Area for Filter Engineering

Pall Corp., manufacturer of filters for removal of materials in the low micron ranges, has added 7,600 sq. ft. of engineering and executive space to its facilities in Glen Cove, N. Y., most of which will be used for doubling present engineering facilities.

The company recently completed an expansion of 6,700 sq. ft. of the machine shop facilities of Glen Components, a subsidiary.

Air Force Requires ARI Certification

ARI Certification is now required on all unitary air conditioning equipment purchased by the U.S. Air Force.

This requirement was put into effect through an Air Force "pamphlet" (No. AFP 91-2-1) issued over the name of Gen. Thomas D. White, chief of staff, and dated Jan. 29, 1960.

While the pamphlet wording merely "recommends" and "requests" ARI Certification be required, this is actually an order, an Air Force spokesman explained.

A foreword in the pamphlet reads:

"This pamphlet has been developed to give all Air Force Civil Engineer Personnel responsible for refrigeration and air conditioning activities, information concerning the Air Conditioning and Refrigeration Institute Certification Program for Unitary Air Conditioning Equipment, and recommends that the certification be required on this type equipment for the Air Force."

A COMPLETE ENGINEERING AND EQUIPMENT SERVICE

for

AIR POLLUTION CONTROL

YERZLEY SCRUBBERS
BAG FILTERS
CYCLONES

We would welcome the opportunity to discuss your air pollution control problems with you.

QUALITY PRODUCTS JOHN WOOD SINCE 1861

JOHN WOOD COMPANY
AIR POLLUTION CONTROL DIVISION
BERNARDSVILLE, N J. BE 8-1211

Union Relents In N. Y. Flexible Duct Row

A strike by New York City sheet metal workers in protest against installation of flexible metal air duct on an interior air conditioning system ended last month with the union agreeing to install the product over which the controversy had flared.

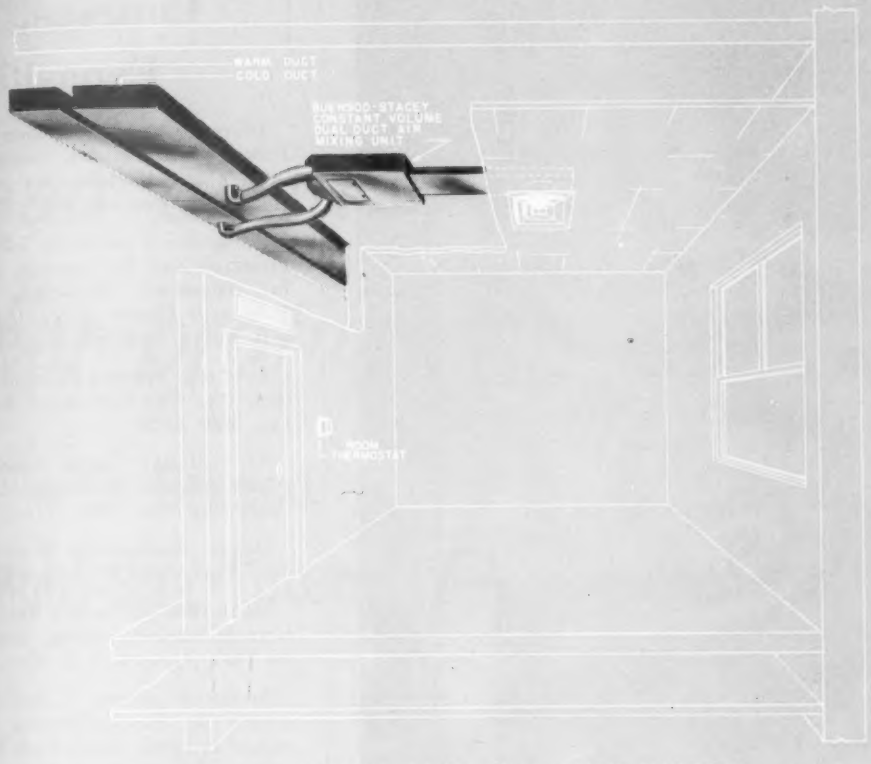
The strike had been called against Triangle Sheet Metal Works, Inc. with the action directed specifically against the air conditioning in the First National City Bank building.

Local 28 of the Sheet Metal Workers International Association insisted that ductwork on the interior system be fabricated by hand.

Union did not object to the use of the flexible duct on exterior systems. The product is made by Carrier Corp. and by Wiremold Corp.

Triangle protested to NLRB that the strike was a secondary boycott, and a temporary restraining order was obtained in a U.S. Court. However, before it was tested the union decided to go back to work.

(Please turn to page 24)



HIGH VELOCITY DUAL DUCT SYSTEM

THE LOGIC OF DUAL-DUCT DESIGN

. . . simplicity, adaptability, flexibility

The best solution to a problem is always the simplest solution. For example — the problem of maintaining selective, zoned comfort control in office buildings, hospitals, hotels, schools, apartment houses and other modern structures. In most cases, the best solution is the High Velocity Dual-Duct method, pioneered and developed by Buensod-Stacey. This one system heats, cools and provides proper humidification all year-'round. It is easily adaptable to your architectural design problems and, after installation, is extremely simple and economical to operate. The system's inherent flexibility readily handles changing zone requirements.

So for your next project, whether it's a new or renovated structure, plan on Dual-Duct, because Buensod developed it. If you'd like more information we've prepared an illustrated "Architects' Guide to Dual-Duct Air Conditioning." It's yours for the asking.

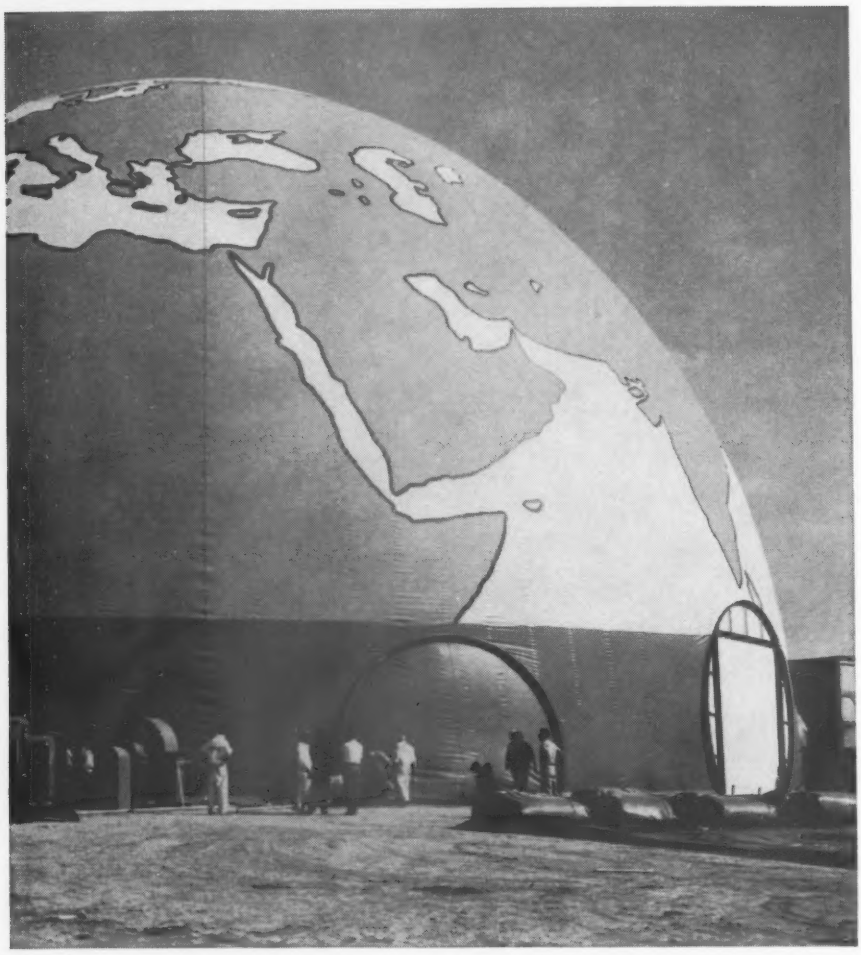
BUENSOD DUAL-DUCT

BUENSOD-STACEY

Dept. A, Buensod-Stacey Corp. 45 West 18 Street, New York 11, N. Y.

Subsidiary of Aeronca Manufacturing Corporation

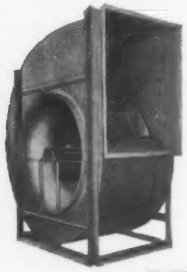
ANOTHER PEERLESS ELECTRIC SPECIAL BLOWER APPLICATION



How to Stabilize Air-Supported Structures

EVEN IN 70 MPH WINDS, PEERLESS ELECTRIC BLOWERS FIRMLY SUPPORT THESE HUGE ARMY PENTADOMES

Twelve Peerless Electric Centrifugal Blowers, each with a discharge of 22,000 cfm, are responsible for the inflation and support of the Army's hemispheric "Pentadome." Designed for use as missile maintenance centers, the structures tower as high as a nine-story building, cover 17,000 square feet of floor area and hold over a million cubic feet of volume.



CERTIFIED RATINGS AMCA

Peerless Electric has pioneered the application of inflating and maintaining a variety of air-supported structures, including Radomes. The same skills that engineer air for Pentadomes can go to work for you. Write to *Peerless Electric Division, H. K. Porter Company, Inc., West Market Street, Warren, Ohio.*

PEERLESS ELECTRIC DIVISION

PORTER

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Meetings, Courses, Expositions

Instrument Society of America, second Instrument-Automation conference and exhibit, *Civic Auditorium and Brooks Hall, San Francisco, May 9-12.*

Postgraduate course in "Effects of Air Pollution and Environment on Health" for engineers, physicians, educators, *Wisconsin Center Bldg., University of Wisconsin, Madison, Wis., May 19-20.*

Industrial Heating Equipment Association, Inc., *The Homestead, Hot Springs, Va., May 22-25.*

Air Pollution Control Association 53rd annual meeting, *Netherland-Hilton hotel, Cincinnati, May 22-26.*

Design Engineering Show, *Coliseum, New York City, May 23-26.*

Institute of Boiler and Radiator Manufacturers annual meeting, *Seaview Country Club, Absecon, N. J., Week of June 6.*

American Society of Heating, Refrigerating & Air-Conditioning Engineers annual meeting, *Royal York hotel, Vancouver, B.C., Can., June 13-15.*

Engineering seminar on electrical precipitation in fly-ash and cement dust collection, *Pennsylvania State University, University Park, Pa., June 12-17.*

American Society for Testing Materials annual meeting, *Chalfonte-Haddon Hall hotel, Atlantic City, N. J., June 26-July 1.*

Engineering seminar on architectural and engineering planning aspects of atomic shelters, *Pennsylvania State University, University Park, Pa., July 10-22.*

Engineering seminar on structural engineering and radiation shielding aspects of atomic shelters, *Pennsylvania State University, University Park, Pa., July 24-Aug. 5.*

13th International Congress on Occupational Health. *Waldorf-Astoria hotel, New York City, July 25-29.*

American Chemical Society fall meeting, *Chicago, Sept. 3-8.*

Production Engineering Show, *Navy Pier, Chicago, Sept. 6-16.*

East Central Section, Air Pollution Control Association, *Sheraton-Cadillac Hotel, Detroit, Sept. 22-23.*

National Metal Exposition, *Philadelphia, Oct. 17-21.*

Institute of Boiler and Radiator Manufacturers semi-annual meeting, *Seaview Country Club, Absecon, N. J., Week of Oct. 31.*

Industrial Hygiene Foundation 25th annual meeting, *Mellon Institute, Pittsburgh, Oct. 26-27.*

clean plants, clear profits

with Dracco Multi-Bag Filters

Freedom from dust in your plant can mean:

- **lower plant maintenance and cleaning costs**
- **less abrasive wear on machinery**
- **no raw material waste**
- **better working conditions**
- **improved manpower and machine efficiency**
- **no air pollution**
- **guaranteed product purity**

High-efficiency cloth filtration with Multi-Bag Filters can help you clear the way for profits in any or all of these areas. Wide range of standard sizes permits engineering to meet almost any dry collection requirement. Units can be installed in or out of the plant. Operation may be intermittent or continuous, depending on dust loads and degree of automation desired. Long-life filter bags are available in any type cloth, natural or synthetic.

Freedom from maintenance is another benefit that helps you clear extra profits. Simplified, rugged, design with few moving parts keeps Dracco maintenance costs lowest in the industry, year after year.

For full information on Multi-Bag Filters, and other units in Dracco's complete line of dry collection equipment, write: Dracco Division of Fuller Company, Harvard Avenue and East 116th Street, Cleveland 5, Ohio.

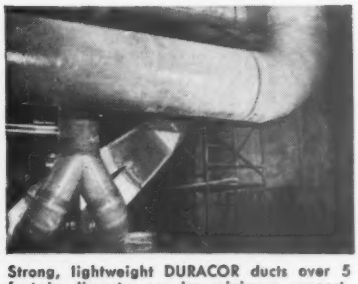
DRACCO *airstream* conveyors
dust control equipment

SPECIAL COLLECTORS
Dracco is also experienced in design and fabrication of large custom-built collectors, using glass or other synthetic cloth bags, to solve extremely severe or unusual dust problems.

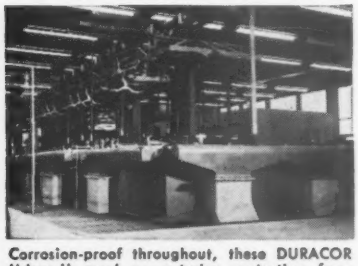
Typical Multi-Bag Filter system at large eastern processing plant shows how standard units can be grouped together to provide unlimited capacities.

another corrosive fumes ventilating problem

Duracor Ventilation System exhausts 250,000 C.F.M. of corrosive fumes from large electronic equipment plant.



Strong, lightweight DURACOR ducts over 5 feet in diameter require minimum support.



Corrosion-proof throughout, these DURACOR "drops" need no exterior protection from spillage.

Weather and corrosion resistance are provided by DURACOR "T" sections on roof.

PROBLEM: This ventilating system had to withstand sulphuric, nitric, chromic, phosphoric acid and cyanide fumes emitted from the plant's plating and anodizing operation.

SOLUTION: Working from customer specifications, Ceilcote engineers built the entire ventilating system shown here completely from DURACOR.

INSTALLATION: Experienced Ceilcote supervisors and crews handled the complete installation under one contract. Materials and workmanship are fully guaranteed.

WHAT'S YOUR PROBLEM? . . . DURACOR resists any corrosive gas, fume or liquid . . . can be fabricated to virtually any shape. Write today and tell us about your requirements.

DURACOR CEILCOTE

8019-CC

THE CEILCOTE COMPANY, INC.

4988 Ridge Road • Cleveland 9, Ohio

Pollution Complaint$

Cleveland, Ohio—City Council's air pollution committee has asked the city law department to "investigate the feasibility" of declaring the No. 5 battery of coke ovens at Republic Steel Corp. to be a public nuisance and a menace to health and welfare. It also raises the question of whether the ovens should be sealed or torn down "as soon as possible."

The company claims the ovens are not a nuisance or health hazard, and that without the ovens the firm would have to shut down steel production. Republic is planning a 26-million dollar expansion program in Cleveland.

Slides shown at the Council hearing were said to prove that "the fumes (one day in December) were so thick that it was impossible for vehicles to drive safely on Broadway, S.E.

• • •

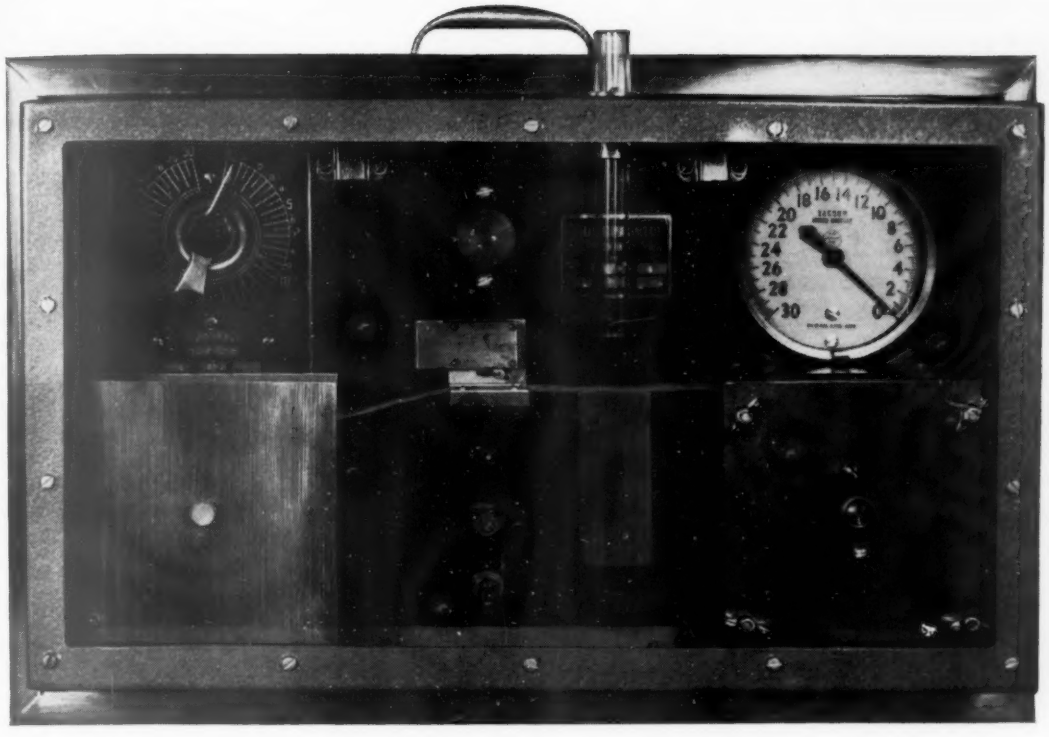
Troutdale, Ore.—Sustained, by Supreme Court, a $91,500 judgment awarded local livestock farmer as a result of damages done to his cattle grazing acreage by fluoride fumes from adjacent aluminum reduction plant of Reynolds Metals Co.

Reynolds, in appealing the decision of the Oregon Supreme Court, contended that the Oregon Courts had distorted the state's law of trespass, and that in addition, in approving the trespass for the damage award, had denied Reynolds equal protection of the laws. The Supreme Court, in refusing to review the case, made no comment, but its action had the effect of sustaining the state court action.

• • •

Youngstown, Ohio—Youngstown Sheet & Tube Co. announced that it has begun a scientific study of air pollution problems at an estimated cost of $100,000 for the first year. An air sampling laboratory will be operated around the clock, according to E. O. Reese, district manager, to sample air near and at distances from the plant.

The research study will be directed toward proving or disproving charges made by city and state air pollution control and health officials that a "black rain" which has plagued area residents for over 15 years, comes from Youngstown Sheet & Tube Co.'s plant.



NEW RAC HI-FLOW TAPE SAMPLER*

offers greater testing versatility

Here is a tape sampler specifically designed to collect atmospheric particulate matter in a single sample on which multiple tests can be made. This versatility is provided through utilization of high air flow rates per unit area and a microweb filter media. Instrument provides for a complete testing range including destructive and non-destructive analyses.

Compact (15" long, 19" wide, 12" high) and portable (only 54 pounds), the sampler is equipped with a continuous duty, carbon vane rotary pump. An automatic timer permits sampling at any interval from ½ to 30 hours in ½ hour increments. For further details, mail coupon or write to: Research Appliance Company, Box 307, Allison Park, Pa.

*Patterned after sampler developed by the Robert A. Taft Sanitary Engineering Center, U.S. Public Health Service, Cincinnati, Ohio, and described in Nader, J.S.: "A Versatile, High Flowrate Tape Sampler," JAPCA, Vol. 9, No. 1, May 1959

Visit us in booth No. 430 at the A.P.C.A. Show

Gentlemen:

Please send me bulletin number 2263 describing the Hi-Flow Tape Sampler.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

RESEARCH APPLIANCE COMPANY

Box 307 Allison Park, Pa.

News of the Industry . . .

(Continued from page 18)

CEC Challenges GAO On Engineering Policy

A move to have the General Accounting Office of the U.S. government publish verified and objective cost comparisons of projects engineered by public as well as private engineers, is being made by Consulting Engineers Council. The C.E.C. takes issue with some G.A.O. directives which advise government departments and agencies against the use of private engineering firms.

Ralph Westcott, president of the C.E.C., declares that this G.A.O. policy runs contrary to other announced policies of the Federal government, and "assumes" certain conclusions about costs which are not borne out by any studies.

The C.E.C. has formed a special committee to press for the use of private engineering talent by government agencies.

Gives You MORE,
Costs You LESS
Check all the FEATURES!*

RP

Listed

Multi-Velocity INDUSTRIAL AIR FILTER

FOR HEATING OR AIR CONDITIONING

* **ALUMINUM** construction . . . rust-proof . . . corrosion-resistant. Eliminates need for expensive, heavy structural design in filter bank construction.
* **EASY TO HANDLE** Light-weight permits carrying, washing and installing of many more filters per hour.
* **EASY TO CLEAN** Lint and dirt are easily flushed off with water because of water soluble Super Filter Coat (the adhesive with the built-in detergent).
* **DEPTH LOADING** Designed to minimize surface loading, with depth loading accomplished through successive layers of slit and expanded aluminum, and varying baffle sizes.
* **REMOVES ODORS** Revolutionary R P Super Filter Coat adhesive adds odor removal to the normal dirt-trapping properties of R P Industrial Air Filters—with no increase in resistance—at *no* extra cost!
* **GERMICIDAL** Super Filter Coat adhesive contains Hexachlorophene, the well-known bacteria destroying agent.
* **LOWER RESISTANCE** Unique baffle design permits maximum air passage ...more uniform dust collection within the filter depth.
* **HIGHER EFFICIENCY** Scientifically staggered pattern of flat baffles sets up a controlled turbulence that centrifuges dust and odor particles onto the adhesive for maximum efficiency.

for information, write... RP / Products of Research

RESEARCH PRODUCTS Corporation Dept. 448, Madison 1, Wis.

Charge Depository Restrains Trade

A complaint alleging practice of certain illegal restrictions by operators of the Inland Bid Depository of Riverside, Calif. has been filed by the California State Attorney General. The complaint asks for injunctive relief to break up what is allegedly a combination in restraint of trade.

Specific charges against the bid depository include allegation that it is causing sub-contractors to bid only to depository members, and the requirement of the ½ of 1% fee charged to successful bidders, which fee is used for the operation of the bid depository.

Inland has a membership of some 250 sub-contractors. As a bid depository it is engaged in the business of handling and processing bids submitted by its members to general contractors, who thereafter submit competing bids on public projects to awarding authorities in the area.

An attorney for the bid depository stated that he may ask directors to change a rule stating that a sub-contractor cannot bid to a general contractor not using the depository for the job being bid.

Also in California, formation of the Bid Depository of San Diego County was announced as a co-operative non-profit organization designed to serve as a bid deposit and distribution center for the local construction industry.

Offices are at 3907 El Cajon Blvd., where the Allied Trust Fund Administration Service will act as bid custodian.

Lighter Scrubbers Mount on Rooftop

Use of light-weight plastic-packed column scrubbers by chemical process companies in combatting air pollution problems was reported at a meeting of the American Institute of Chemical Engineers by Fred W. Arndt of Heil Process Equipment Corp.

Scrubbers of such construction "possess unique economies where weight is critical, such as for roof mounted locations," Arndt said. "Reduction, or in some case elimination, of expense for reinforcing the scrubber location is significant."

(Please turn to page 26)

*Completely adjustable**

Flooded Disc Scrubber

Removes Sub-Micron Fumes

The Research-Cottrell high efficiency scrubber uses the unique flooded disc principle for removing sub-micron fumes in steel-making furnaces and chemical processing.

As shown in the illustration, the outstanding feature of this scrubber is the simple, adjustable "flooded disc." The flooded disc adjusts for maximum cleaning efficiency over a wide range of operating conditions.

**Automatic positioner immediately adjusts the disc to meet your varying gas and dust control problems.*

Research-Cottrell, with over 48 years of industrial gas cleaning experience, will be glad to consult with you on any specific problem.

For further information, write for Bulletin 110.

Research-Cottrell

RESEARCH-COTTRELL, INC., Main Office and Plant: Bound Brook, N. J.
Representatives in principal cities of U.S. and Canada

RESEARCH COTTRELL INC
TRADE MARK
RC207

NEWS of the Industry . . .

(Continued from page 24)

Building Research Institute

Captures Total Air Treatment Concept

Concept of total air treatment manifested itself strongly at a recent seminar on air cleaning and purification, part of the recent spring conference of the Building Research Institute held in the Statler-Hilton hotel, New York City.

Finn J. Larsen, vice president of research, Minneapolis - Honeywell Regulator Co., predicted that we are just beginning to have insight into a new era of comfort control.

He called for more research on the production of negative ions and their beneficial effect on health, healing rates, emotional health, and learning ability. He predicted that if present indications hold true, future air conditioning systems in buildings of all types will include negative ion systems.

Odor sensation control, said Larsen, may well be part of future air conditioning systems, not so much from the standpoint of controlling *objectionable* odors, which we already know how to do, but from the standpoint of providing desirable odor *climates,* such as invigorating mountain-top, pine scented air . . . and similar odor environments, all at push-button command.

Thus at the push of a button, seashore odors may be brought into the conditioned space . . . along with solar effects from hidden batteries of sunlamps.

Thus, instead of controlling heat and humidity, tomorrow's air conditioning system may be able to duplicate many complete climates . . . odors, breezes, ozone, negative ions, and all, to produce any desired effect to soothe, calm, relax or stimulate.

William L. McGrath, chief engineer, Unitary Equipment Division, Carrier Corp., called for a concept of "Total Air Treatment" that would eliminate dirt and smog-laden air from homes and other buildings, and help alleviate infiltration of radioactive particles in the event of atomic warfare.

Arthur J. Hess, president of Hess, Greiner, and Pollard of Los Angeles, commented that bacteria control in air streams "has been noted as a problem in the past few years and techniques (for their control) are developing."

He said that the industry needs more research on sources of bacteria and life span of bacteria in air streams.

Air filtration, he concluded, "has been woefully neglected by the air conditioning industry in favor of heating and cooling equipment, or in other words, comfort."

He called for a reappraisal of air filtration and its emphasis as a health guard in the industry.

H. L. Barnebey, vice president of Barnebey-Cheney Co., Columbus, Ohio, discussed classification and removal of odors.

He gave the following as a suggested specification for air quality in an occupied space:

SPECIFICATIONS FOR AIR QUALITY

Absolute pressure	23-35 in. Hg.
Oxygen content	18-21 percent
Carbon dioxide	.6 percent maximum
Dust (and other particulate matter)	.05 gr./1000 cf max.
Bacteria count	5 per 10 cf max.
Odor	20 ppm max. 2 thresholds max.
Toxic vapors	Below published limits

(Please turn to page 60)

Supreme Court Rules Detroit Smoke Law Applies to Ships

The United States Supreme Court has ruled that the city of Detroit can enforce its anti-smoke ordinance against ships passing the city along the Detroit river.

The 1947 ordinance had been challenged by the Huron Portland Cement Co. after two of its ships had been ticketed in December, 1956. The company contended that since it was licensed under the Treasury department, the ordinance interfered with interstate commerce.

The Supreme Court ruled that the ordinance was not in conflict with Federal law. It said possession of a federal license does not immunize vessels from the operation of normal incidents of local police power, not constituting a direct regulation of commerce.

Morton Sterling, chief of the Detroit Bureau of Air Pollution Control, said 80 ships had been ticketed under the ordinance. He said he intended to consult with shipping companies to work out a reasonable program of compliance.

The ordinance calls for penalties up to $100 and 30 days in jail for each day of violation.

Huron Portland Cement contends it would cost the company $70,000 to $100,000 per ship to control smoke.

Fitch Recommends Major Changes In N. Y. Dept. of Air Pollution Control

Some major changes in New York City's Department of Air Pollution Control were recommended to Mayor Wagner by Acting City Administrator Lyle C. Fitch. The changes would include abolition of the Board of Air Pollution Control.

There was some speculation that the Fitch report was aimed at assisting the new Commissioner of Air Pollution Control, Arthur J. Benline, in reorganizing the department "for greater efficiency." Benline succeeds Dr. Leonard Greenburg, the department's first commissioner, who retired in January.

In his report Dr. Fitch found there was "little evidence" of any basic improvement in the city's air pollution situation since the department came into being in 1952.

Criticism was directed at the department for building its enforcement policy almost solely on citizens' complaints. Instead, said Dr. Fitch, there should be more routine patrol work by inspectors.

Dr. Fitch recommended dividing the department into two major bureaus—a bureau of inspection and enforcement and a bureau of engineering, research, and planning.

Also recommended were replacement of the present bureau of records by a division of personnel and office services, and creation of a new legal unit.

Dr. Fitch would have the city create a motorized, radio-equipped, city-wide complaint squad to make special investigations requiring immediate attention.

New Literature

Yerzley Scrubber Bulletin

Four-page bulletin introduces the Yerzley scrubber for air pollution control through principle of interphase reaction. Bulletin provides operating data, explains how it works, gives dimensions, and lists advantages. Industrial applications are pointed out.

Source: *Air Pollution Control Div., John Wood Co., Dept. AE, Essex Bldg., Bernardsville, N. J.*

Air-Meter Catalog

Catalog 170 is a four page folder describing the various models of Hastings Air-Meters. Included are model for application in the ranges of 5 to 200 fpm. Probes and gas flowmeters are also described.

Source: *Hastings-Raydist, Inc., Dept. AE, Hampton, Va.*

Electric Process Heat Bulletin

How liquid heat transfer units for heating jacketed equipment of all types can be used in the process industries is described fully in four page bulletin No. 102.2.

Diagrams and specifications of Hynes heating equipment along with illustrated examples are included.

Source: *Hynes Electric Heating Co., Dept. AE, P. O. Box 1004, Mountainside, N. J.*

New Mercury Switch Control Catalog

Complete line of mercury switch equipped controls for single stage pressure, two-stage pressure, differential pressure, liquid level, and mechanical movement applications is described in Catalog 860.

Each control is accompanied with specifications and engineering data which can be easily located through a dual index in the catalog.

Source: *The Mercoid Corp., Dept. AE, 5201 Belmont Ave., Chicago 41, Ill.*

Plastic Ventilating Products Bulletin

Corrosion resistant ducts, fittings, hoods, stacks, and elbows manufactured by Heil Process are described in Bulletin B-500. Specifications, listing of standard sizes, and chemical resistance data are included.

With the bulletin, engineers are able to completely layout corrosion resistant system for handling corrosive fume using standard parts.

Source: *Heil Process Equip. Corp., Dept. AE, 12901 Elmwood Ave., Cleveland 11, Ohio.*

New Membrane Sub-Micron Filter Manual

Manual No. 3 entitled, "Study of Fine Particles" is a ten page booklet written for bacteriologists, medical researchers, engineers, chemists, and industrial hygienists. Manual contains information regarding methods of isolating, sizing, counting and identifying fine particles in air, gas, and liquid streams, with the aid of membrane filters.

Techniques for use in air pollution, health physics, industrial hygiene, and industrial control are also included.

Source: *Gelman Instrument Co., Dept. AE, Chelsea, Mich.*

Manufacturing Chemists' Clinical Safety Pamphlet

"Health Factors in Safe Handling of Chemicals" is the first in a series of Safety Guides Pamphlets to be issued by the Manufacturing Chemists' Assn. Inc.

Booklet contains information to help the non-chemist become familiar with toxicological terminology, understand ways by which noxious substances enter the body and exert their harmful effects, and to know the basic principles of first aid treatment.

Copies are 15 cents each.

Source: *Manufacturing Chemists' Assn., Inc., Dept. AE, 1825 Connecticut Ave., N.W., Washington 9, D. C.*

Recold Air Conditioners

Completely revised catalog #54C9c for Recold vertical and horizontal air conditioning units contains general specifications, dimensions, arrangements and installation instructions for these units.

The V-UHT air conditioning units are offered in either Class I or Class II construction.

Source: *Recold Corp., Dept. AE, 7250 East Slauson Ave., Los Angeles 22.*

Evaporative Water-Cooler Bulletin

Complete line of evaporative water coolers manufactured by Drayer-Hanson is described in Bulletin PFCF 531.01. Bulletin contains eight pages of descriptive literature on these blow-through type units and is a one-source engineering bulletin giving unit selections charts and tables.

It stresses importance of counter-flow operation of evaporative water coolers especially in areas where hard or corrosive water conditions occur.

Source: *Drayer-Hanson Div., The Crane Co., Dept. AE, 3301 Medford St., Los Angeles 63, Calif.*

Incinerator Bulletin

Bulletin 184 illustrates complete line of incinerators for commercial, industrial, and domestic use offered by Morse Boulger. Charts, cross-reference tables, extensive selection tables, and design data for each type of incinerator are included to aid the engineer in selecting particular unit for each application.

New Incinerator Model E is introduced and complete specification data is included.

Source: *Morse Boulger, Inc., Dept. AE, 80 Fifth Ave., New York 11, N. Y.*

Gas-Fired Unit Ventilator Bulletin

Herman Nelson UNIvent gas-fired unit ventilators for use in classrooms are described in Bulletin 685-A1. Contains 16 pages of construction features, engineering and specifications data, operation and controls information, dimension drawings, and weight charts.

Included are application diagrams for free standing units.

Source: *American Air Filter Co., Inc., Dept. AE, Louisville 8, Ky.*

Round Power Ventilators

Complete specifications on Bowman round power ventilators are given in Bulletin RPV-1. Bulletin describes both standard and automatic types and lists both capacities and dimensions.

Source: *Bowman Steel Corp., Dept. AE, Box 2129, Pittsburgh 30, Pa.*

Better Air for Industry

PART VI

by Richard V. Sloan, *Senior Engineer*
American Air Filter Co.
Los Angeles, Calif.

In this final part of the series on air cleaning equipment selection, author outlines recirculation and make-up air problems.

WITH THE EXPANDING USE of local exhaust ventilation, the volume of air handled in most industrial plants has increased each year. Discharge of air to the outside introduces a number of problems such as:

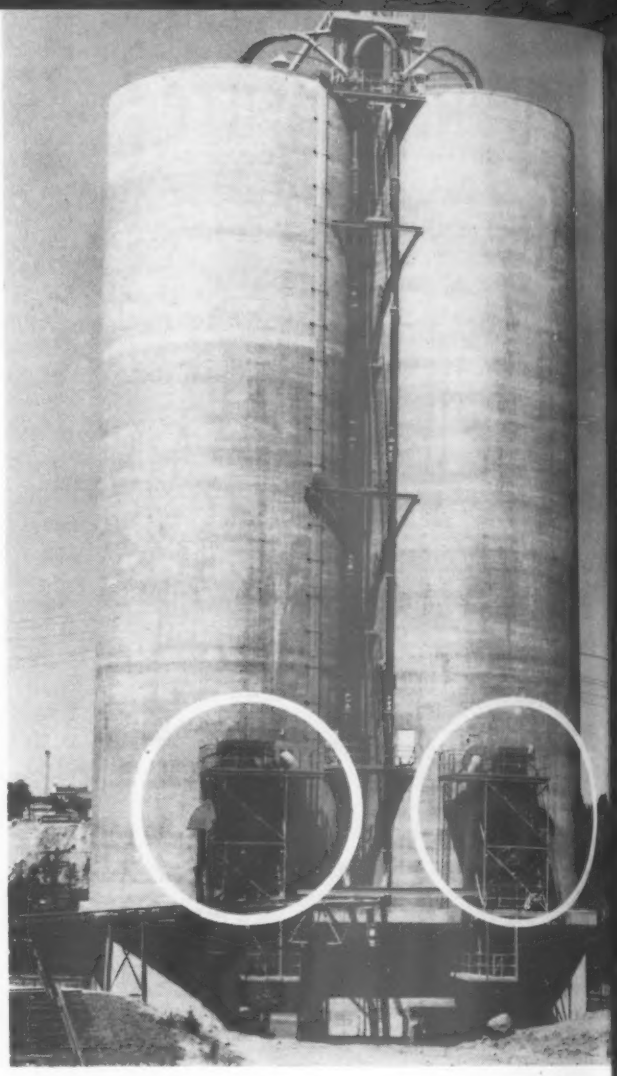
(1) Substantial heat loss, not only increasing the cost of plant heating but often straining heating plant capacity.

(2) Severe economic loss in plants where cooling and/or humidity control is supplied.

(3) Added expense for plants that must frequently change production layouts. This means relocation of dust producing materials with extensive alterations to exhaust ducts discharging through roof or outside wall.

It is the goal of dust collector manufacturers to develop equipment that will permit safe recirculation of all industrial contaminants. But that point in design and fool proof operation has not been reached particularly where toxic materials are collected.

Most authorities are reluctant to recommend recirculation from collectors handling toxic dusts, fumes, mists, or vapors as there is no assurance that required high degree of efficiency will be maintained. No recording instruments have been developed to indicate when safe degree of cleanliness of effluent has been exceeded.



Cement bagging and storage exhaust system is handled by a reverse jet bag type collector.

Recirculation from non-toxic materials does not introduce such hazards. Recirculation from processes involving metal working, woodworking, food products, pharmaceuticals, grain dust, and oil fumes has been used extensively in industry.

Dust collectors designed for recirculation will normally be more expensive and often require more service attention. These factors should be weighed against the advantages of recirculation before a decision is made to return the cleaned air.

Make-up Air Supply. Every plant engineer will admit that you can not discharge air from exhaust systems to the outside without replacement air entering the plant. Yet hundreds of exhaust systems operate with reduced effectiveness during the winter months because of an air-locked plant.

Doors that almost refuse to be opened because of negative pressure in the workroom, cold drafts of outside air sucked through cracks around windows and doors, reverse air flow into the plant from roof combustion gas stacks, ventilators, and propeller exhaust fans – all are indicators that the workroom urgently needs a makeup air supply system. ▲▲

What You Should Know About RESPIRATORS

PART III

by H. H. Fawcett
Research Laboratory
General Electric Co.

Here's data on air supplied respirators of value to the factory air engineer.

THE FUNDAMENTAL LIMITATIONS of any air purifying device are that the air must be within the limits for which the respirator was designed (for example, the oxygen content must be over 16 percent, the particular unit will only protect against the specific substance or combinations for which it was designed, (for example, aerosol (dispersoid) (filter type) respirators will give no protection against gases and vapors), and the canister or filter must be maintained in proper working condition (on a properly maintained facepiece that fits snugly enough to exclude leakage).

Since the simplest solution to all respiratory problems is to supply pure air to the breather (Fig. 1), use of an air supply from some remote source where the air is not contaminated is both simple and logical. For many applications, air-supplied equipment has real advantages, but this equipment is subject to definite limitations.

Fig. 1: *This light weight, air-supplied hood offers protection against contaminated air.*

Simplest type is the Bureau of Mines Type B hose mask, which is a facepiece to which is attached a hose without a blower which must extend to a respirable source of air. This mask depends on the breathing action of the wearer to move the air. For this reason, maximum hose length of 75 ft. has been established for hose mask without blower. However, such a unit should not be used in atmospheres immediately harmful to life or from which the wearer could not escape without the device.

Low pressure blowers, operated either by hand or by power (power blowers do not carry Bureau of Mines approval) are used to supply Bureau of Mines Type A hose masks up to 150 ft. All hoses should originate at the blower. A respirable source of air must be assured, and a safety man must be present at the blower at all times. Fouling of the hose may cut off the air supply, and the exit route must be the same as the entrance route. These hose masks can be used safely only if the above precautions are observed.

Air Inflated Suits

Air helmets, air hoods (Fig. 2) and air-supplied suits have the same general limitations as for air-line respirators. An interesting development in this field is the use of air-inflated suits for protection of the whole body against hazardous materials. In one form, the large impervious plastic tunnel or pipe allows a man to work in one room while using air from another—the slight air pressure supplied giving both breathing air and inflation (or body) to the suit. Front of the suit is tailored into a facepiece, and arms with gloves are attached. Mobility is reported good within the obvious limits imposed by length of the tunnel attached.

In another form, a complete suit with built-in arms and legs is supplied with air for inflation and a hood, also air supplied, is used for head, face and respiratory protection. Depending on the particular fabric, plastic, or composition used in its construction, this suit allows work inside tanks, reaction vessels and other confined space which still contain a hazardous atmosphere. Properly used, together with safeguards to insure that the wearer's air supply and life-line are always in proper position and working order, this suit has increased safety and decreased operating costs in maintenance work inside tanks containing materials which are corrosive or are easily absorbed through the skin such as aromatic amino and nitro compounds. The same limitations noted above for air-line respirators should be noted.

Regardless of the type "respirator" used, a definite program of control is necessary to insure that the device is actually used properly, is properly maintained, and that it is doing what is expected of it.

Next month, self-contained respirators will be discussed. ▲▲

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53rd Annual Meeting of Air Pollution Association

When: May 22-26.

Where: Cincinnati, Netherland-Hilton

SOME SIXTY SEVEN PAPERS covering all aspects of air pollution control will be presented at the 53rd annual meeting of the Air Pollution Control Association to be staged in the Netherland-Hilton hotel, Cincinnati, May 22 to 26.

More than 400 air pollution control officials, research workers, and industrial representatives are expected to attend the 18 sessions and to visit exhibits set up by 19 manufacturers of instruments and pollution control equipment.

Wednesday afternoon, May 25, will be devoted to tours of industrial plants and research installations in the Cincinnati area doing outstanding work in air pollution control.

Registration for the meeting is $25. This includes admission to all technical sessions, get-acquainted mixer, president's luncheon, cocktail party, "Gay 90's" banquet and review, choice of tours, and $3 credit toward purchase of preprints of papers or complete copy of proceedings. Ladies registration is $12.

Five of the 18 sessions will be general in nature. The others will be devoted to particular subjects, with three or four papers delivered at each session.

Tentative program published by APCA gives the following picture of technical sessions:

Three concurrent sessions will be held Monday morning and afternoon, Wednesday morning, and Thursday morning and afternoon. On Tuesday, two sessions will be held in the morning and the keynote session in the afternoon.

Type of session and papers scheduled to be discussed are:

MONDAY MORNING, May 23

COMMUNITY SURVEYS: Pollution levels in rural southern Ontario, Variation of different pollutants in the atmosphere of Mexico City, and An air pollution study of El Paso, Texas.

INDUSTRIAL AIR POLLUTION CONTROL: Petroleum industry's clean air program, Multipurpose flare stack for control of process wastes, and 99.98 percent efficiency scrubbing for combustion aerosols.

GENERAL: Effects of high volatile fuels on incinerator effluents, Unsolved problem of flue-fed incinerators, and The visibility trend in the central valley of California.

MONDAY AFTERNOON, May 23

AIR QUALITY STANDARDS: Standards for air quality in California, Analysis of California aerometric data for the establishment of bases for air quality standards, Application of air quality standards to a community problem, and Effects of vertical temperature difference on soiling index.

GENERAL: Eye irritants formed by photooxidation of hydrocarbons and oxides of nitrogen; Relation of eye irritation in synthetic systems to atmospheric eye irritation; The occurrence, distribution, and significance of photochemical air pollution in the United States and Canada; and Sampling stations and time requirements for urban air pollution surveys.

GENERAL: New gas-liquid interphase reactor for air pollution control, Achieving greater sensitivity in source sampling by the S-N modification to the high volume air sampler, Comprehensive area surveys in New York state, and Objective odor pollution control investigations.

TUESDAY MORNING, May 24

AUTOMOTIVE EXHAUST RESEARCH: Lead, carbon monoxide, and traffic; Automobile exhaust particulates—source and variation; The role of engine blow-by in air pollution; and Exhaust composition in relation to fuel composition.

CONTROL OFFICERS CONFERENCE: Industry preferred local enforcement, Legal aspects of state versus local control, Why enforcement agency prefers local enforcement, and The preference for state level enforcement.

TUESDAY AFTERNOON, May 24

KEYNOTE SESSION: Three keynote speakers are: Dr. John D. Porterfield, deputy surgeon general of the U. S. Public Health Service; Cornelius Wandmacher, associate dean of the college of engineering, University of Cincinnati; and George T. Minasian, director of community relations, Consolidated Edison Co., New York City.

WEDNESDAY MORNING, May 25

HEALTH EFFECTS RESEARCH: Mortality studies and air pollution indices, Carcinogenic bioassays on air pollutants, and Air pollution and health: general description of a study in Nashville, Tenn.

AIR QUALITY MONITORING AND SAMPLING METHODS: Atmospheric fluoride monitoring with special notes on methods and techniques, Dispersion and effects of airborne fluorides in central Florida, A recommended method for soiling index surveys by automatic filter paper sampler, and The lead content of the atmosphere.

ZONING, PLANNING, AND ADMINISTRATION: Air pollution potential advisory service for industrial zoning cases, Experience in industrial performance standards for zoning, Meeting the deterrents to

EXHIBITORS

Airkem, Inc.
Beckman Instruments, Inc.
Catalytic Combustion Corp.
Central Scientific Co.
Chemical Construction Corp.
Coulter Instruments
Gelman Instrument Co.
Heil Process Equipment Corp.
John Wood Co.
Joseph Goder Incinerators
Kirk & Blum Mfg. Co.
Mine Safety Appliances Co.
Morse Boulger, Inc.
National Dust Collector Corp.
Oxy-Catalyst, Inc.
Perkin-Elmer Corp.
Pulverizing Machinery, Div. of Metals Disintegrating Co.
Research Appliances Co.
Wheelabrator Corp.

effective zoning control of area source air, and The development of motor vehicle exhaust emission standards in California.

THURSDAY MORNING, May 26

METEOROLOGICAL RESEARCH: Interim report on full scale study of dispersion of stack gases, Atmospheric dispersion over longer travel distances, Valley wind phenomena and air pollution problems, and The relationship between peak and mean concentrations.

ANALYTICAL METHODS: Chromatography of polycyclic hydrocarbon mixtures from air, Application of gas chromatographic methods for air pollution studies, Gas chromatography analysis of combustion effluents, and An inspection method for automobile hydrocarbon emission.

CONTROL EQUIPMENT RESEARCH: Successful cleaning of open-hearth exhaust gas with a high energy venturi scrubber, Research on control of emissions from Bessemer converters, Fabric filters for high temperature gases, and Rating of dust collectors according to dust settling velocities.

THURSDAY AFTERNOON, May 26

INSTRUMENT DEVELOPMENT: Continuous parts per billion recorder for air contaminants, Monitoring sulfur dioxide with lead peroxide cylinders, A simplified method for determining ozone levels in community air pollution surveys, and an evaluation of aerometric probe.

AGRICULTURAL RESEARCH: Status and redirection of research on atmospheric pollutants toxic to field crops in southern California, Government sponsored air pollution research relating to agriculture, The biological scientist in an air pollution control program, and Air pollution from the grain industry.

GENERAL: Planning an environmental survey for a nuclear power plant site, Reconnoitering the air: procedures for analyzing local air pollution concentration and contributions, Interrelations between levels of various particulate air pollutants, and Control of odors from a continuous soap making process.

Conference chairman is Charles W. Gruber, air pollution control and heating engineer, bureau of air pollution control and heating inspection, Cincinnati. ▲▲

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FOR CLEAN AIR . . . THE INVISIBLE TOOL

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DUST AND FUME CONTROL

How to Balance Big Building Air Conditioning Systems

by Sidney A. Littmann
Chief Mechanical Engineer
Giffels and Rossetti,
Architects and Engineers

PART II

Here are methods of balancing the air distribution system that will assure owner satisfaction, top system performance and minimum time spent on the job. Use of instruments for checking static pressure, air flow, coil output, is detailed.

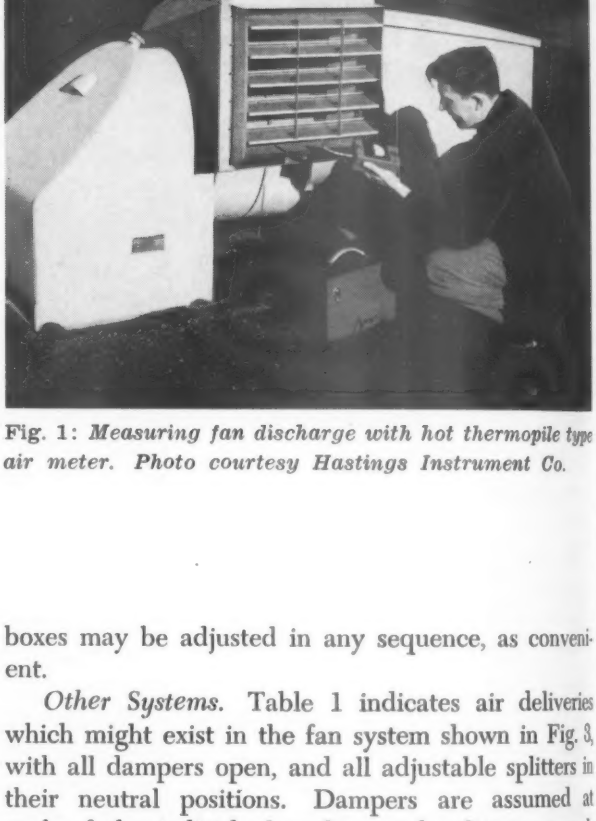


Fig. 1: *Measuring fan discharge with hot thermopile type air meter. Photo courtesy Hastings Instrument Co.*

WE HAVE, in Part I of this series, discussed the importance of balancing to achieve design conditions and long term owner satisfaction.

It was pointed out that the general contractor is responsible for owner satisfaction, but that ultimate system performance rests with how well the mechanical contractor does his job of system balancing.

The author recommended provisions for adequate balancing be included in specifications, and that the architect and/or engineer assure himself that balancing has been achieved before turning the building over to the owner.

Actual techniques of system balancing are now taken up, for both high and low velocity air conditioning and heating designs.

High Velocity Systems. With automatic controls at the mixing boxes, which will, when once set, maintain constant delivery to the connected outlets, it is only necessary to set these controls to produce the required delivery. Changes made at other mixing boxes will not affect delivery at mixing boxes which have already been set. It is desirable, when setting the control device, to measure air flow at the outlets, to verify calibration of controls. Mixing boxes may be adjusted in any sequence, as convenient.

Other Systems. Table 1 indicates air deliveries which might exist in the fan system shown in Fig. 3, with all dampers open, and all adjustable splitters in their neutral positions. Dampers are assumed at each of the individual outlets, and splitters at each split of the main (upstream of points 1 and 2, and points 3 and 4). Ordinarily, the lowest ratio of actual to designed delivery will exist in the most remote branch, and this is the condition shown in the table, at outlet A.

To bring this system into balance, it is necessary to successively reduce the flow to outlets B, C, D, and E, until their flows are in the same ratio to design as outlet A. At first glance, it does not seem to make sense to reduce the delivery of branch B, which is already below design, but this is the only way in which the pressure drops throughout the system can be made equal.

As the flow to branch B is reduced, less total air will flow through the fan and through the branch main beyond point 1. There will thus be less resistance in the ductwork leading to branch A, and a greater pressure at the fan, both of which result

in greater pressure and consequently more flow at outlet A. This might result in a delivery of 125 cfm at outlet A, so the delivery at outlet B should be adjusted to 62.5 cfm.

If these two outlets now have the same ratio of actual to design delivery, they will remain in balance (between themselves), regardless of what is done with the rest of the system.

The next step is to reduce delivery at outlet C until it is in proportion to branches A and B. Again, as C is reduced, A and B deliveries will be increased. There will, however, be a net reduction in total air flow to this portion of the system, as its overall resistance is increased.

To check that the outlet being adjusted is in balance with those already balanced, it is necessary to check only one of the previously adjusted branches, not all of them.

The procedure as outlined above for outlets A, B and C, should now be repeated or continued for outlets D and E. As the original delivery of this portion of the system, with all dampers wide open, was 88 percent of design, the final delivery, as balanced, will fall somewhat below this figure, but higher than 60 percent, which was the minimum value for any of the outlets.

Repeat Operation for 2 and 4

Having balanced branch main 1, the operation must be repeated for branch mains 2 and 4. Branch main 1 should be completely ignored while balancing branch main 2. Branch mains 1 and 2 should be likewise completely ignored while balancing branch main 4, because whatever is done to outlets F through O will have no effect on the balance between outlets A through E, although total delivery through outlets A through E may increase somewhat during the process.

Branch main 4 may give some trouble, because the outlet having the lowest initial percentage of designed delivery is not the last outlet on the branch main. Here it is necessary to adjust the last outlet(s) P and U to the same percentage of designed delivery as exists at the outlet having the least ratio of actual to design delivery, and then proceed as was done for branch main 1.

As the artificial increase in resistance of the system should be kept as small as possible, it may be desirable to return to outlets P and U, and readjust their deliveries upward if, at the time P, U, and V have been adjusted, they are found to have lower ratios of actual to designed delivery than exist at point Q. Having attained balance of these four outlets, procedure as outlined for outlets A through E can be followed for the remainder of branch main 4.

With the outlets on each branch main in balance, the procedure is next extended to put the several branch mains into balance. This is done by adjustment of the splitter dampers at the junction of these branch mains with the main duct. Again, since balance between various outlets on the branch main will not be upset by changes in pressure at start of the branch main, it is only necessary to balance outlets J and E, for example, by adjustment of the splitter damper at 1-2. Branch mains 1 and 2 will then be in balance. Once 1 and 2 are in balance, they can be balanced with branch main 4 by the splitter damper at 3-4, by comparing only two outlets, one on branch main 4, and any other one.

Balancing All Outlets Does Not Complete Procedure

Having all outlets in balance does not yet conclude the balancing procedure. It is only necessary that the ratio of actual to designed delivery, which has been accepted and made the same for all the outlets, now be made to equal 100 percent. If it exceeds 100 percent after the outlet adjustment is finished, fan speed may be reduced to suit.

Similarly, the fan speed may be increased if this ratio remained less than 100 percent. However, care must be taken, in increasing fan speed, not to overload the motor. Checking motor input, static pressure across the fan, and fan rpm at this stage of the operation will provide significant information as to accuracy of measurements made of outlet deliveries, and will show up any major resistances in the system.

A substantial difference between fan delivery as found on the manufacturer's multi-rating tables, and measured outlet deliveries would indicate that correction of the latter measurements are warranted.

Fan static pressure. To measure fan static pressure, an inclined manometer or draft gauge should

(Please turn to following page)

Fig. 2: *Checking air velocity at diffuser with air velocity meter. Photo courtesy Bacharach Instrument Co.*

(Continued from preceding page)

be used. The instrument must be properly leveled, and correct fluid must be used to conform with the specific gravity for which the instrument is calibrated. In selecting points for pressure sensing, care must be taken to avoid locations which are subject to impact pressures.

Fan Speed. Fan speed should be read with a revolution counter over a timed period. Some instruments are made which automatically time the period of engagement of the counting mechanism; with others, the operation is timed with a stop watch.

A glance at any multi-rating table will show that this reading must be quite accurate. A slight difference in fan speed makes a substantial difference in the rated delivery. Use of tachometers which may be off by one or two percent is therefore not recommended.

Outlet Air Flow. Ordinarily, air flow at outlets is measured by determining velocity at the outlet, and multiplying by the area, to find cfm. Instruments for this purpose are:

Vane anemometer. Use of this instrument is limited to measurement of flows normal to the face of grilles or registers larger than diameter of the anemometer. Within this limitation, certain other precautions are necessary. The instrument should be calibrated, and should be used only within its proper range.

Damage to the instrument can result from using it for velocities in excess of those for which it was designed, and inaccurate readings will be obtained below the range of calibration. When applied to inlet openings, a correction factor must be applied, depending upon the characteristics of the instrument.

In the event velocity across the face of the register is not uniform, the vane anemometer will read the highest velocity passing over its blades, which may result in an erroneous reading.

For larger registers or grilles, it is necessary to run a traverse, dividing the face into equal areas of about twice the dimension of the anemometer, and measuring the velocity at each. These readings are then averaged to determine the velocity which is to be multiplied by the face area to give flow.

Velometer. This instrument reads directly in feet per minute, and is available with a number of probes. It should be used as recommended by the manufacturer. The velometer is especially useful for measuring tangential velocity at the tip of inner diffusing plates of ceiling diffusers. For this purpose, a number of diffuser manufacturers provide multipliers for each size diffuser which, when applied to the velometer reading will give the air flow through the diffuser in cfm. For accuracy, several readings should be taken around the perimeter of the diffuser, and their average used.

A probe is available for the velometer, by means of which duct velocities may be measured. This necessitates cutting a 1 in. hole in the duct, and requires a traverse similar to that used with a pilot tube. In view of these factors, measurement of duct

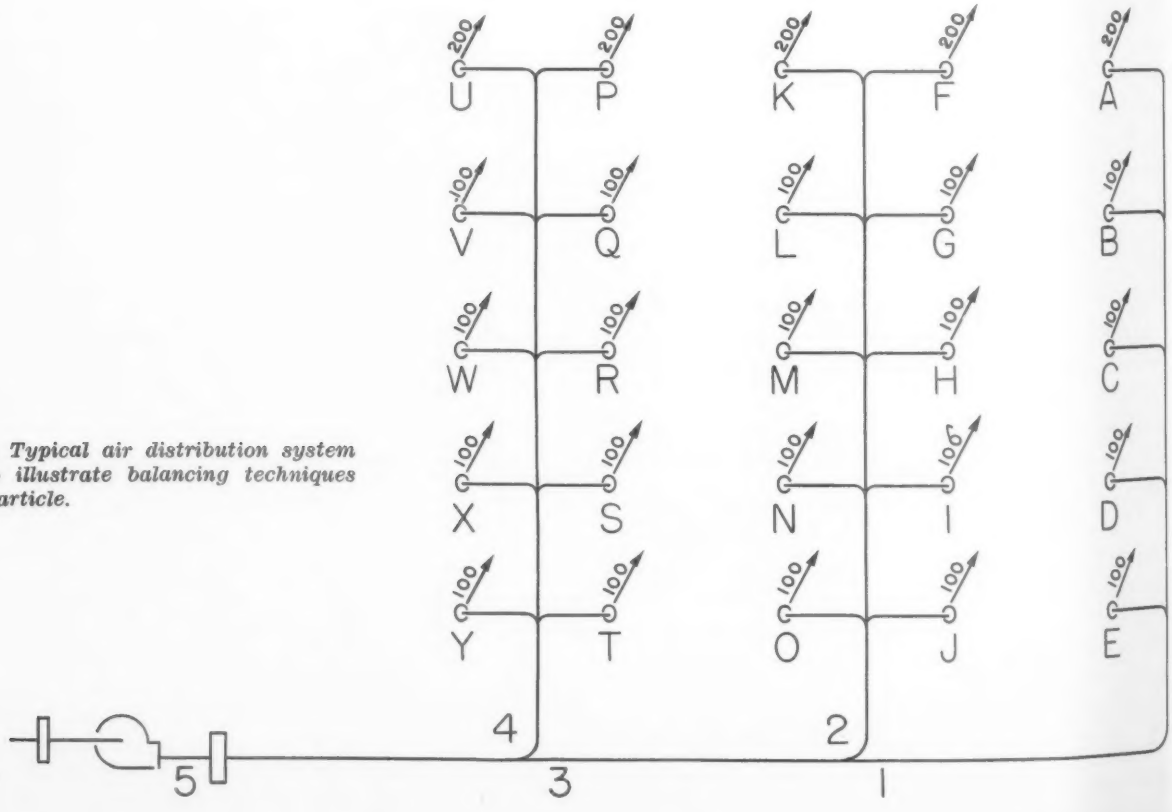


Fig. 3: ***Typical air distribution system used to illustrate balancing techniques in this article.***

velocity in this manner is recommended only where measurement of outlet delivery is, for some reason, not practicable.

Pitot tube and manometer. This combination is the most reliable of flow measurement devices, and is quite useful for laboratory work, or for calibration of the other instruments discussed herein. However, its use requires considerable field work not associated with the other instruments, and it is not ordinarily used for balancing procedures.

To obtain proper readings, it is desirable that at least 10 diameters of straight duct be upstream of the point of measurement, and 2 to 5 diameters of straight duct downstream. An opening must be cut in the duct for insertion of the tube, and a traverse is required to obtain a proper average of the duct velocities. Each manometer reading must be converted from velocity pressure to velocity.

At velocities under about 1500 fpm, the velocity pressure is so low that the manometer is difficult to read accurately, and readings of velocity pressures corresponding to less than 1000 fpm can be expected to be quite unreliable. This combination should be used only as a last-ditch stand, or where extreme precision is required at high velocities.

Hot-wide Anemometer. This is perhaps the most versatile of devices which may be used for the purpose. It is capable of measuring temperatures, static pressure, and several ranges of velocity. It will not be damaged if used at the wrong range of velocity.

For diffusers it may be used in the same manner as the velometer, or the probe may be inserted in the neck of the diffuser and the neck area used instead of the multiplier referred to above.

The hot-wire anemometer is not highly directional in its response, however, and if used with single or double deflection grilles requires correction by the cosine of the angle of deflection. It is also very rapid in its response, and a number of readings are required if a suitable average velocity is to be obtained.

Hot-Wire Anemometer Also Measures Duct Velocity

The hot-wire anemometer may also be used for measuring duct velocity, in the same manner as with the velometer or pitot tube. If it becomes necessary to determine the diameter of a circular duct, a flexible tape reading in centimeters will be useful. Diameter in inches = circumference in cm., divided by 8.

The discussion so far has been limited to balancing of the ventilation portion of the air conditioning system. Equally important, but frequently ignored or avoided, is balancing of the hot water and chilled water systems. Where a perimeter hot water heating system is installed, it should be adjusted to obtain the same return water temperature at all sections of radiation, with design water temperature supplied, and all dampers open, while all thermostats are calling for full heating. A surface pyrometer will be found most useful for these measurements.

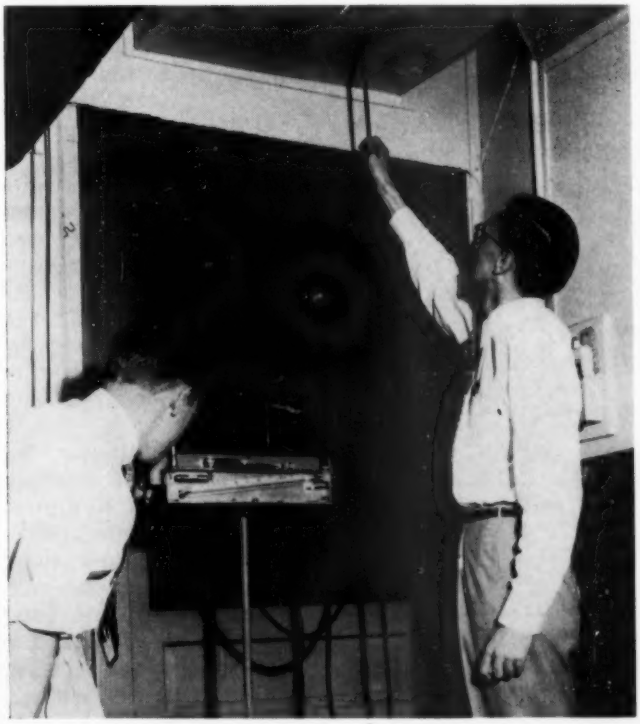
TABLE 1

Outlet	Initial Measured Delivery	Percent of Design
A	120	60
B	90	90
C	120	120
D	140	140
E	160	160
F	150	75
G	75	75
H	80	80
I	85	85
J	100	100
K	175	88
L	80	80
M	90	90
N	120	120
O	90	90
P	220	110
Q	160	80
R	100	100
S	110	110
T	130	130
U	170	85
V	110	110
W	120	120
X	150	150
Y	110	110

The rate of water flow to unit heaters can be set

(Please turn to page 61)

Fig. 4: *In an industrial ventilation system, these air engineers are shown balancing the air distribution system with a portable, inclined tube draft gage and a pitot tube. Photo courtesy York Corporation and Ellison Draft Gage Co., Inc.*



To meet clean air quality standards here's a

New Way To Scrub Incinerator Gases

Smoky, smelly incinerators are being legislated out of existence. If your commercial or industrial unit is a problem, this gas scrubber may be a solution.

Fig. 2: *Left, this scrubber is installed on a flue-fed incinerator to clean gases.*

by Seymour Smith
Scrubber Division
Peabody Engineering Corp.

THE FLUE-FED INCINERATOR is a convenient means for the disposal or reduction of domestic rubbish and garbage in apartment buildings. In a flue-fed incinerator the refuse is charged by the tenants through service doors connecting into the flue at each floor as shown on Fig. 1. The material is accumulated in the furnace and is usually ignited by the janitor or attendant early in the morning. Products of combustion pass up through the same flue and are discharged to atmosphere at a suitable distance above the roof.

Flue-fed incinerators as described above are widely used throughout the country and in New York City alone there are an estimated 11,000 flue-fed incinerators, which burn approximately 600,000 tons of refuse annually.

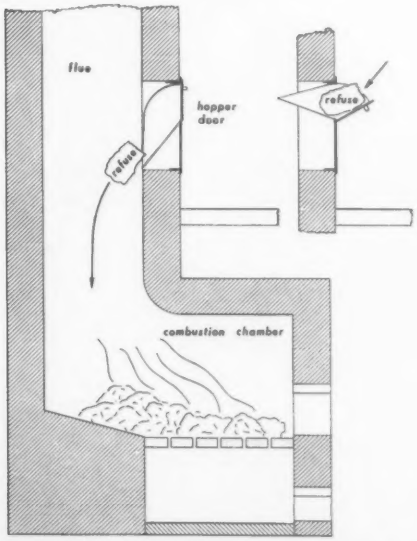


Fig. 1: *Typical flue-fed incinerator design, where refuse is charged through service doors in flue.*

To combat the problem of air pollution caused by use of such incinerators, many cities have adopted restrictions against new installations, unless some approved devices are installed to limit their outlet dust emissions.

Through the use of a well designed package scrubber, and a method for drawing gas from a single chamber flue, it is possible to limit outlet dust emissions and turn incinerators which operate in violation of air pollution ordinances into acceptable ones.

A custom engineered package unit, designed specifically for incinerator use, includes the scrubber, recycle pump, liquid tank, fan and motor. As a complete package it can be set in place and connected to existing facilities. (See Fig. 2.)

Operation of this system can be described as follows:

For flue-fed incinerators in multi-story buildings one manufacturer incorporates a fixed gas-by-pass to atmosphere which operates automatically during short peak load periods when gas volumes are excessive. This unique construction prevents blow-back through furnace and charging doors. The by-pass incorporates a large mesh basket which is usually about 12 in.

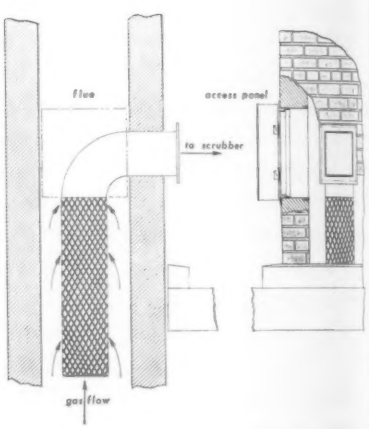


Fig. 3: *Basket gas inlet and bypass arrangement in center of the flue.*

square and 4 ft. long and is positioned in the center of the flue as shown in Fig. 3.

The basket will trap any large pieces of refuse which would interfere with operation of scrubber and permits free discharge of flue gas and by-passing of the scrubber in case of power failure. A quick-opening access panel is supplied and built directly into the flue wall for cleaning and inspection purposes.

On entering the scrubber, hot dirty flue gases are first sprayed by means of a group of low pressure spray nozzles. The spray zone serves to cool and thoroughly saturate the gas and also to strip it of coarser dust particles. Part of the water coming from the sprays is directed upward and

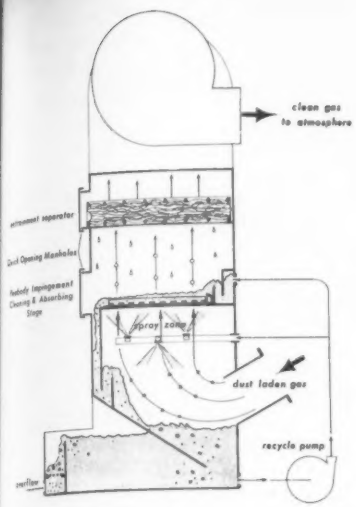


Fig. 4: *Cutaway view of package scrubber designed to clean flue gases.*

keeps the unit free from any accumulations. (See Fig. 4.)

After passing through a spray zone, conditioned gas in the scrubber illustrated passes through an impingement baffle plate cleaning stage. This stage, illustrated in Fig. 5 comprises a plate having 600 to 3000 orifices per square foot, surmounted by an impingement baffle plate assembly with a baffle directly over each orifice. The baffles are submerged in a blanket of scrubbing liquid which flows across the stage. Its depth is controlled by a weir.

Gas flowing upward is divided into thousands of jets by the orifices. Each jet aspirates liquid from the blanket and creates a wetted surface on the baffle located at the point of maximum jet velocity. The directed impingement on a wetted target dynamically precipitates particles and entraps them in the scrubbing liquid.

Each jet, on impingement, forms minute gas bubbles which rise through and create turbulence in the liquid blanket. This provides extremely close gas-liquid contact for maximum cleaning, high heat transfer and maximum absorption of solubles. Continuous violent agitation of the blanket by the bubbles prevents settling of entrapped particles and flushes them away in the scrubbing liquid.

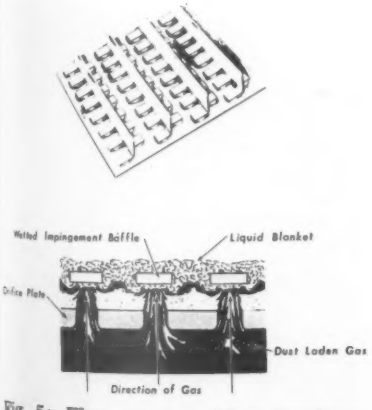


Fig. 5: *Flue gas scrubber impingement baffle plate.*

After leaving the impingement plates stage, the gas passes through an entrainment separator located at the top of the unit and leaves clean and free of entrained water. The gas can be discharged either through the flue or directly to atmosphere, whichever method suits the job conditions best.

Scrubbing liquid at zero head is introduced on the top baffle plate stage. It flows across the stage and over a weir to provide a controlled liquid blanket thickness, then flows through a drain and liquid seal to the stage below.

The liquid then falls to the pump tank at the base of the unit. Branch take-offs from the pump discharge line admit water to a spray header located underneath the impingement baffle plate. The sprays are generally adjusted to operate between 15-20 psig. In order to compensate for evaporative losses, a fresh water make-up supply is added to the system either directly over the top of the impingement baffle plate stage or into the pump tank. The average amount of fresh water does not exceed 1 gpm. The recycle pump is mounted on a base plate adjacent to the pump tank, draws water from the tank and delivers it to the various inlets. A small stream of water from the scrubber over-flow flushes and removes the collected dirt.

The scrubber and fan are designed for necessary capacity to treat full stack load, except for a short time after light-off, when a peak load would be encountered for a period of 20-30 seconds.

In New York City the height of apartment houses under new construction has been ranging from 6 to 20 stories. For the scrubbers shown the houses have been divided into three (3) classifications; up to 6 stories, 7-14 stories, 15 and over. After conducting experiments on typical incinerators, accurate data were obtained to size the units. Three basic sizes, PSS No. 1, 2 and 3 have been selected

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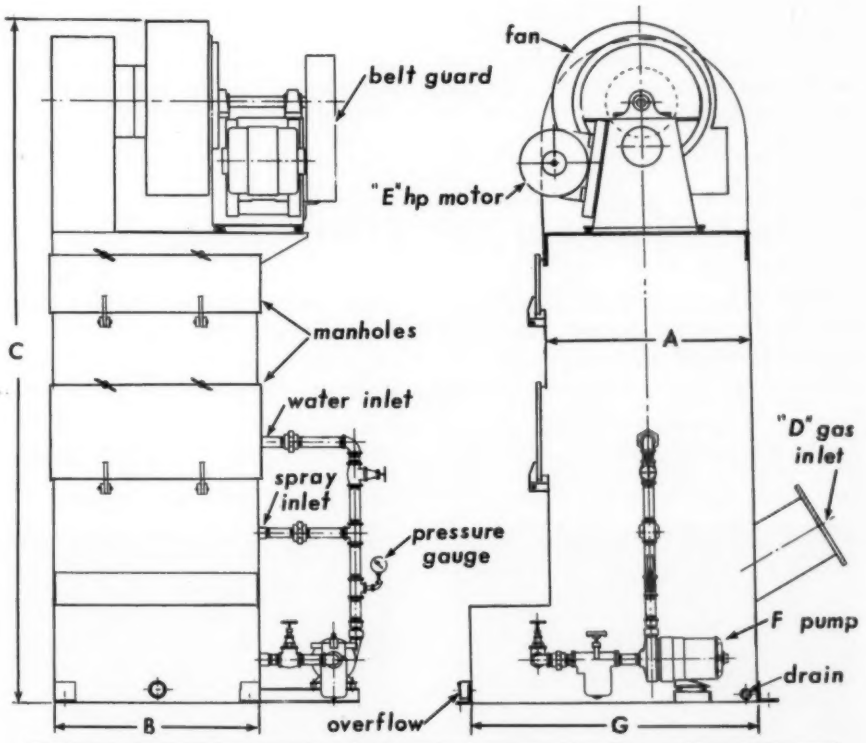

CODE No.	CFM	A	B	C	D	E	F HP	F GPM	G
PSS - 1/2	500	18"	18"	7'-3"	6"	3/4 HP	3/4	30	34"
PSS - 1	1000	24"	24"	8'-3-3/4"	8"	1-1/2 HP	3/4	30	40"
PSS - 2	1500	24"	30"	8'-7-1/4"	10"	3 HP	3/4	30	46"
PSS - 3	2000	30"	30"	8'-7-1/4"	12"	3 HP	3/4	30	52"
PSS - 4	3000	30"	36"	9'-1-1/2"	14"	5 HP	1	40	52"

Fig. 6: ***Standard scrubber sizes for flue-fed incinerators. Chart courtesy Peabody Engineering Corp.***

Gas Scrubbers

(Continued from preceding page)

to cover the classifications mentioned above. The units and their auxiliaries are shown on Fig. 6.

Because owners of apartment houses can ill afford luxury of a separate attendant for maintenance of the scrubber, their porter must do this work. In view of this unskilled labor special precautions must be used in designing a very simple operating unit, that can be serviced with a minimum of attention.

Such a unit (Fig. 2) is completely automatic and can be started by the porter from the basement prior to lighting his fire, by simply pushing a remote control button. The push button has an indicating light which when lit indicates that the system is in operation. The maintenance requirement has been reduced to only infrequent routine cleaning of the equipment and of periodic inspection of the internals through quick-opening doors.

A report* issued by New York University under sponsorship of the U.S. Public Health Service and the New York Department of Air Pollution covering investigations to reduce incinerator emissions to the atmosphere states:—"The maximum reduction of particulate emissions during the burning period was obtained by the use of a Peabody gas scrubber." The scrubber had a collection efficiency up to 96 percent.

The report states that cost of such a "package scrubber" for apartment house incinerators is approximately $2500. This does not include installation and hookup. Operating costs per year are stated to be approximately $100 for equipment, maintenance and repairs, $263 for power based on a maximum 7½ hp motor, and $33 for water.

Besides flue fed incinerator service, gas scrubbers are being widely used to combat air pollution from industrial and municipal incinerators. The flow cycle of a scrubber for industrial and municipal incinerators is illustrated by Fig. 7.

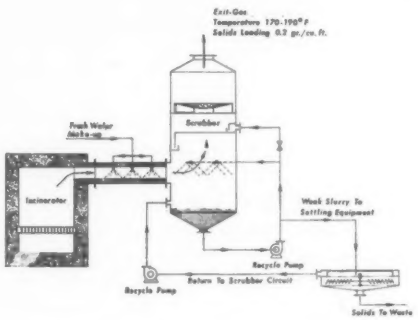

Fig. 7: *Typical industrial and municipal incinerator and gas scrubber flow cycle. Type of scrubber shown above, and described in this article, can be used on both apartment house and industrial incinerators.*

Gas scrubbers are being used on virtually every kind of destructor type incinerator. Their applications include the burning of pathological wastes, plastics, cars, factory wastes, waste fuels (boron and sodium) etc.

Recently a municipal incinerator handling garbage and treated sewer sludge was installed at Whitemarsh Township in Pennsylvania. The plant capacity was 12½ tons/hour. A gas scrubber having a nominal capacity of 150,000 cfm handling all the combustion gases from the operation reduced dust emissions below the prevailing Air Pollution Code requirements.

Scrubbers for municipal incinerators usually have inlet loadings in the range of 2-5 grains/standard/cu. ft. and they reduce this to an outlet loading of approximately 0.2 grains/standard cubic foot (adjusted to 12 percent CO_2).

In conclusion it is felt that as the local air pollution codes become more stringent the demand for gas scrubbers to limit dust emissions from incinerators will become stronger and stronger. ▲▲

*REFERENCE

"Modifications to reduce emissions from a flue-fed incinerator by E. R. Kaiser, J. Halitsky, M. B. Jacobs, and L. C. McCabe." Presented to Air Pollution Control Association at Meeting in Los Angeles, California June, 1959.

Airborne Bacteria . . . Its Control

The spread of disease through the air and its control has long been a function of the air engineer.

Since the pioneering studies of Wells the study of droplet infections and their control by air sanitation devices has been studied both by epidemiologists and those concerned with the design of air conditioning and air distribution systems for hospitals and other areas where people congregate.

Fig. 1: *A violent, unstifled sneeze, completed, shows droplet dispersion. Photos taken with intense 1/30,000th sec. flash against dark background.*

Fig. 2: *Enunciating the letter "F". Consonants are more difficult than vowels to pronounce without forming droplets. Note larger droplets.*

Fig. 3: *A sneeze through a mask of the type worn by surgeons. Mask was constructed of a layer of cotton flannel between two layers of muslin.*

CONTROLLING AIRBORNE BACTERIA . . .

How Well Can It Be Done With Today's Air Sanitation Methods?

Here's a review of current air sanitation methods and devices, and how they are applied in air distribution systems.

PART II

by Melvin W. First, Sc. D.
Consulting and Research Engineer
Newton Highlands, Mass.

PART I OF THIS TWO-PART SERIES *discussed the serious aspect of hospital staphylococcus aureus infections, outlined how bacteria are transmitted from person to person, and evaluated various methods of air sanitation.*

In this month's article the author points out how the engineering of air as applied to air distribution systems can be used to keep airborne bacteria at a minimum. The author points out that the art of air engineering is sufficiently advanced to provide hospital air which is sterile, dust-free and odor-free.

Fig. 1: *Large, modern hospitals like the building above may soon be outmoded without effective air sanitation devices.*

AIR FILTERS are widely used for dust removal and commercial units are available which range in airborne dust removal efficiency from approximately 5 percent to better than 99.99 percent. Only those filters capable of removing approximately 99 percent of airborne bacteria are likely to be of practical value in the production of bacteria-free air. Allan[10] reported the results obtained with several high efficiency filter media tested with a laboratory-generated droplet nuclei aerosol and with naturally occurring dust-borne bacteria as follows:

Filter	Filtration Velocity fpm	Bacterial droplet nuclei	Effic. % dust-borne bacteria
H93 glass fiber paper	5.5	99.97	100
H93B glass asbestos paper	5.0	96.7–98.1	100
Fiberfrax ceramic paper	5.0	97 –98	>99
50-FG glass fiber mat	21.0	87 –99	>99
Aerosolve 95 glass fiber mat	23.0	89 –98	>99
Aerosolve 85 glass fiber mat	25.0	54 –69	..

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Decker, et al[11], found that 10 mil thick filter papers made from Micro-fibers passed two bacteria out of every 100 million when filtration velocity through the paper was 20 fpm but only one half this number when filtration velocity was reduced to 10 fpm. Air filters made with similar papers are available commercially and, as indicated by these experiments, are capable of preparing virtually sterile air.

Electrostatic precipitators designed for ventilation applications remove between 85 and 95 percent of atmospheric dust by the discoloration test, and bacterial removal efficiencies are in this general range.

A question often arises concerning the survival of bacteria trapped on filters and electrostatic precipitators. A few investigators have stated that viable bacteria can be found on filter surfaces after a few days of operation but there is no indication that these are other than recently deposited organisms. *The survival problem associated with air sampling by filtration, discussed earlier, would indicate that bacteria trapped on an air filter die off at a greatly accelerated rate.*

Practical Methods of Air Sanitation

It will be apparent from this brief review of methods used to disinfect air that while reasonable and economical means are available to deliver sterile air to operating rooms and other hospital areas, there is no satisfactory method for rapidly disinfecting bacteria discharged by the occupants. Consequently, all reasonable means must be employed (a) to remove freshly formed droplet nuclei by dilution with bacteria-free air and (b) to prevent dust-borne bacteria resting on floor, furniture and clothing from becoming resuspended in the room air.

In the experiment cited earlier it was seen that the bacterial content of the air increased as the number of occupants increased. That this increase was caused in large part by resuspension of settled bacteria-laden dust was indicated when only a 21 percent reduction in bacteria count followed a four-fold increase in ventilation rate while there were nine occupants; whereas under similar conditions, except that the number of occupants was two, the count was reduced 65 percent.

This suggests that dilution alone may not provide satisfactory control and Yaglou and Wilson[6] point out that increasing the supply of bacteria-free dilution air may actually increase air bacteria by stirring up infected dust particles from the floor and other surfaces. They found that air velocities as low as 50 fpm directed across the floor were capable of resuspending large numbers of organisms.

Direct application of these principles has not yet become widespread in hospital design. For example, in a recently completed (1959) hospital building, it was observed that air for ventilation, heating and cooling was introduced into ward rooms and service rooms at velocities between 400 and 500 fpm and was evacuated from these areas by flowing under doors to a central corridor which served as an exhaust air plenum.

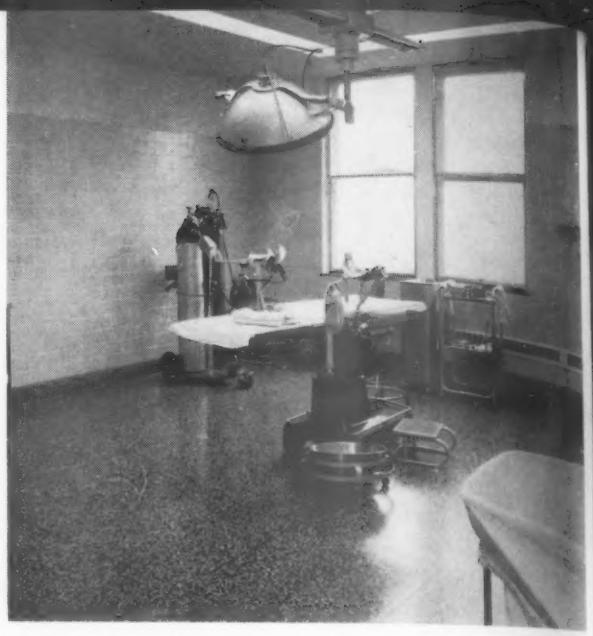


Fig. 2: *Operating rooms and post-operating areas must be supplied with bacteria-free air. This article tells how air sanitation can be used to keep air germ-free. Photo courtesy Surface Combustion Div., Midland-Ross Corp.*

Procedure May Be Criticized

In addition to the fact that use of corridors as air plenums is contrary to the building and fire codes of many communities, this arrangement may be criticized on several other counts: first, supply air velocities are excessive from the standpoint of stirring up settled dust; second, discharge of ventilation air under doors creates air velocities far in excess of 50 fpm across floors; third, contaminated air from medical and surgical wards is discharged to central corridors used by visitors, attendants and patients.

Food is delivered to these same corridors, preparatory to serving, and medicines are dispensed from here, also. On the positive side, the entire hospital building, including service facilities, utilizes 100 percent outside air (no recirculation) and operating rooms, delivery rooms, nurseries and other critical areas are maintained at slight positive pressure relative to corridors and adjacent facilities so that contaminated air cannot flow into them from other parts of the hospital building.

For satisfactory control of airborne bacteria, special attention must be given to methods of introducing and removing ventilation air at low velocity. Ideally, air might be supplied through a perforated ceiling and removed through large exhaust registers located in the walls of the room a foot or more above

Fig. 3: *An important aspect of attaining bacteria-free air is to sweep up dust from floors. Germs live on dust particles. Specially designed sweepers like the one shown above can do the job. Beware of ordinary sweepers . . . they may do more harm than good. Photo courtesy The Kent Co.*

the floor, thereby eliminating high velocity air currents across floors and other surfaces on which dust may settle. Air flow rates may be greatly reduced by greater use of low temperature heating panels which produce far lower room convection velocities than hot air heating or conventional radiators. This method would have special application to hospitals when ceiling panels are employed, since bed patients would receive maximum radiation from such a source.

Floor sweeping and furniture dusting is best done with central vacuum cleaning systems so that blower, dust separator and discharge duct can be located out-of-doors where residual dust may be safely discharged and motor noise will not be a problem. Allan[10] has shown that when self-contained portable vacuum cleaners must be employed at least one type is capable of removing up to 99.99 percent of airborne bacteria. This cleaner is equipped with a high grade dust filter and a means for mechanically sealing the filter to prevent air leaks.

The primary objections to portable unit-type vacuum cleaners in hospitals are: (1) failure of the dust filter due to rupture or incorrect installation results in massive dissemination of dirt and bacteria and (2) the discharged air from the vacuum cleaner produces undesirable high-velocity air currents which resuspend settled dust from floor and furnishings.

Hospital fresh air intakes should be carefully located to avoid introduction of contaminated air discharged from the hospital power plant, laundry, incinerator, kitchens, laboratories, service and toilet rooms. Protecting the purity of the air source is an excellent sanitary practice, analagous in all respects to preserving the cleanliness of potable water supplies and, in addition, greatly reduces the costs of processing the air for hospital use.

Light and sun are powerful allies in killing airborne bacteria. Studies with hemolytic strepptococci and pneumococci showed survival rates of bacteria exposed to daylight to be only $\frac{1}{17}$ to $\frac{1}{120}$ those exposed in a dark room.

Thus, it may be seen that supply air disinfection and scrupulous sanitation, alone, important as they are, cannot guarantee bacteria-free air in hospitals. *In a very real sense the entire structure must be engineered for air sanitation if satisfactory conditions are to be maintained at a reasonable cost.* The role of building design in maintaining air purity is becoming increasingly clear and architects are recognizing that structural and aesthetic considerations cease to be controlling when they vitally affect air movement into and through the hospital.

The ultimate responsibility for establishing and

(Please turn to page 61)

Fig. 4: *Air intakes for the air distribution system should not be located near sources of dirt and germs. This rooftop penthouse is a good place to locate air intake to supply the building.*

New Appointments

James A. Gray has been named general sales manager of Connor Engineering Corp. Gray will supervise and direct the sale of Connor's three product lines, the high velocity valve attenuators, Kno-Draft air diffusers, and Dorex air purification equipment.

Gray

Before joining Connor, he had been with the Worthington Corporation for 10 years.

Rufus C. Stillman has been appointed assistant to the president of The Torrington Mfg. Co.

Stillman

Stillman, who had been director of industrial relations and assistant to the general manager of the air impeller division, will now assist the president, Andrew Gagarin, in operating matters in the air impeller, specialty blower, and machine divisions. He will continue to have overall responsibility for personnel and advertising functions.

Milton L. Hoglund and **Wesley W. Wright** have been appointed to new managerial positions by The Trane Co., and arrangements have been made to move **Robert C. Binnion** from the Trane sales office in Dallas to the home office in La Crosse.

Hoglund

Hoglund has been appointed manager of refrigeration applications engineering.

Wright will succeed Hoglund as manager of centrifigal compressor sales. He was the assistant manager of this department.

Wright

Binnion, who was a sales engineer, will join the centrifugal compressor sales department in La Crosse.

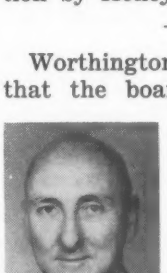
Minneapolis-Honeywell Regulator Co. has announced the following appointments:

Stephen F. Keating to the board of directors and **Carl Boyer, Jr.** as chief engineer of its Rubicon Instruments Div. in Philadelphia.

Keating is a vice president of Honeywell and is head of its military products group. He has been with M-H since 1948 and a corporate vice president since 1956.

Boyer has been chief evaluation engineer for the company's Brown Instruments Div. and was employed by the Rubicon Co. for a number of years before its acquisition by Honeywell.

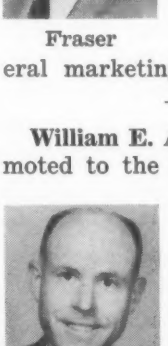
Worthington Corp. announced that the board of directors has elected **A. William Fraser** vice president and general sales manager. Fraser was formerly general marketing manager.



Fraser

He joined Worthington in 1929 as a sales engineer. He was appointed general marketing manager in 1957.

William E. Archer has been promoted to the position of manager of research development for the Western Precipitation Div. of Joy Mfg. Co. and **Pat Zilliacus** has been appointed manager of agency sales.



Archer

Archer was most recently chief development engineer for the division, directing among other things the gas flow and design studies of electrostatic precipitators and experimental work on new types of mechanical dust collectors.

Zilliacus was formerly with the industrial division of Joy and now will be responsible for all product sales made through manufacturers agents and other divisions of Joy.

H. P. Peterson, sales engineer, will be responsible for sales and product development for the Refrigeration, Heating and Air Conditioning Products Div., Tenney Engineering, Inc. has announced.

Airtemp Div. of Chrysler Corp. has appointed:

Baker

Lawrence H. Baker as manager of branch sales. He was formerly senior engineer in applied machinery and systems.

Henly M. Milburn as business and market research manager. He was previously manager of sales planning, residential products.

Arthur L. Foster as advertising manager. He was formerly Airtemp account executive with Close and Patenaude, Dayton sales promotion agency.

Ernest Kroder has been appointed chief engineer of the standard products line of Copeland Refrigeration Corp., refrigeration compressor manufacturer. Kroder was formerly associated with the Lehigh Mfg. Co. as general manager of special products.

Kroder

Copeland also announced the appointments of **Walter Runciman** as assistant to the national service manager and **Arne Perttola** as manager of field educational services.

Runciman had previously been service manager with Brunner Div., Dunham-Bush, Inc. Perttola was formerly assistant to the national service manager.

Appointment of **Don F. Bennett** as assistant vice president of marketing and **Irving G. Brennan** as product sales manager of air conditioning was announced by Warren Webster & Co.

Bennett

Bennett has served as manager of the radiation and unit heater division and has been with the firm for 18 years.

Brennan has been with the firm for 19 years, working in the engineering and sales divisions.

How Air Is Handled At Idlewild . . .

Different buildings, most designed by different architects, have same usage, same source of Btu's, but different air handling system. Part I tells story of heat and cold distribution to buildings.

by Charles Broder
Mechanical Engineer
The Port of New York Authority

PART I

THE NEW YORK INTERNATIONAL AIRPORT is located on Jamaica Bay in New York City's Queens County. Only a short fifteen miles from busy midtown Manhattan, it is the gateway to the United States for millions of foreign visitors. Many millions more find the airport as the main entrance to the many famous cities and states along the eastern seaboard.

This busy airport is operated by The Port of New York Authority under a lease agreement with the City of New York. Covering a vast area of 4900 acres, there are contained within its perimeter 17 large hangars for operation and maintenance of aircraft, 5 active runways, a 5-building air cargo center, industrial buildings, taxiways, parking areas, terminal buildings for passengers and many other facilities for a large and complex airport.

Construction of the airport was begun in April, 1942 when the City of New York started placing hydraulic fill over the marshland on the site. It was formally dedicated as an airport July 31, 1948 and has since been expanding rapidly to accommodate the ever increasing demands for air services of all types. With passenger traffic increasing from 222,620 in 1949 to 6,994,264 in 1959, while the total air cargo and mail moved by air increased from a mere 11,460,000 lbs. in 1949 to a total of 270,076,000 lbs. in 1959, planning and construction went on at an ever increasing pace.

To date, cost of construction includes about $60,000,000 spent by the City of New York and over $262,000,000 invested by the Port Authority. Before

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Fig. 1: *This huge complex of buildings at New York's famed Idlewild International Airport have basically the same usage, but different air conditioning and heating systems. Most of the buildings were designed by different architects, and the air distribution systems designed by different consulting engineers.*

Fig. 2: *Eastern Airline's new passenger terminal at Idlewild Airport. Three-story structure is said to be largest of its kind ever built by a single airline. Each terminal building has its own control tower.*

(Continued from preceding page)

planning and construction are completed, many millions more will be spent to provide the facilities needed for increasing demands. It is within the great needs of the airport that the planning of an efficient, albeit very beautiful, passenger area was begun and is now in being. When completed in the near future, it will be the pride of all who helped in its creation and for all the people of the city, it will stand as a symbol of the great port.

The great passenger area of the airport is appropriately called Terminal City, since within its 655 acres are the buildings that furnish all of the services that are required by passengers who travel by air. This Terminal City development is not complete as yet although the general plan is complete and is being implemented to a conclusion. The total cost of Terminal City construction, when completed, will be over $150,000,000.

Included in the area are all of the passenger parking lots, a three-chapel development for the Catholic, Protestant and Jewish faiths, the beautifully landscaped 220-acre park with its fountains and reflecting pools, six U.S. flag airline terminals, the International Arrivals Building for all incoming overseas passengers clearing through immigration, customs and health agencies and the Airline Wing buildings occupied by 21 foreign flag lines for departing overseas passengers. Also included in the area is the 11-story control tower, the temporary terminal building and a Central Heating and Refrigeration Plant.

Terminal City is located in the middle of the airport and is oval in shape, with the buildings located around the perimeter of the oval. This has helped in the planning of the heating and air conditioning facilities for the area and permitted the final installation of the transmission lines.

Central Plant Construction

A careful study indicated that construction of a central plant to furnish high temperature hot water and chilled water to the terminal area buildings was the most efficient way to obtain these utilities. Eliminated was the need to construct a separate plant in each building and have continuing operational and maintenance problems on each. Additionally, the central plant provided overall efficiency not available in a multitude of separate plants, minimized problem of keeping the entire area soot free and, most important, saved valuable space in each terminal for airline operations.

At present, the central plant has four La Mont type high temperature water generators, each having a rated output of 40 million Btu/hr, for a total plant capacity of 160 million Btu/hr. This will probably be increased in the near future to a plant capacity of 280 million Btu/hr. Included in the central plant are nine absorption refrigeration machines for a total

Fig. 4: United Airline's attractive passenger terminal building at Idlewild makes lavish use of glass. Note different appearance of the three pictured terminal buildings, each designed by different architect for same usage.

capacity of 6300 tons. This capacity will also be increased in the near future to about 9100 tons for the plant.

High temperature hot water at 250 psig and 380F is pumped to all of the terminal buildings through 6 miles of underground piping. The return water design temperature is 240F allowing a differential use in the buildings of 140F.

Chilled water is furnished to the terminal buildings at 45F and the return temperature is based at 55F allowing for a 10F rise through use in the building. The chilled water flows through 4 miles of underground piping to the buildings.

Buildings and Usage Capacities

Each of the buildings furnished heat and chilled water by the plant are scheduled for the following usage:

International Arrivals & Wing Bldgs.	45,000 MBH	2,300 Tons
Eastern Airlines Terminal	24,000 MBH	1,290 Tons
Pan American Airlines Terminal	20,000 MBH	706 Tons
American Airlines Terminal	39,000 MBH	880 Tons
United Airlines Terminal	24,000 MBH	710 Tons
Transworld Airlines Terminal	21,000 MBH	540 Tons
Northwest, Northeast & Braniff Terminal	18,000 MBH	540 Tons
Union Terminal	25,000 MBH	750 Tons
P.A. Operations Building	10,000 MBH	50 Tons

Of the above units, the International Arrival and Airline Wing buildings, Eastern, American and United terminals and the Port Authority Operations buildings are completed and operating. The Pan American and Trans World Terminals are under construction and will be in operation shortly. Northwest and the Union Terminal, which will replace the present temporary terminal building, are still in the planning and design stages for a start in construction in the near future.

The above figures on heating and cooling are connected loads for the buildings as constructed or planned. They include snow melting loads and all requirements for domestic hot water and the many needs of restaurants. Requirements for peak building loads occur at different times and, with the number of buildings in operation, the diversity use factor decreases in relationship to the central plant capacity.

There are, however, expansion plans for all the terminals for the future. Generally, these will be small since the overall aspects will have been determined by the original building plans. The central plant will be expanded, as described, to take care of the anticipated increased loads.

Heat Conversion and Use In Terminals

In order to achieve a distribution system to the terminals that would be similar throughout the area and involve a minimum of types of equipment and

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Fig. 3: A tremendous expanse of multi-colored stained glass 317 ft. long and almost 23 ft. high lends an aura of artistic grandeur to American Airline's new "customer centered" passenger terminal at Idlewild Airport. Revolutionary passenger service techniques have been designed into the terminal, which occupies 2¼-acres.

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controls, certain basic criteria was set up. It was determined that the HTHW would be circulated on a closed circuit basis so as to avoid contamination of the water. It was further decided that the cost of generating the HTHW precluded circulating any water to the terminals that could not be used. This would eliminate useless flow and the losses inherent in such flow.

A basic policy was promulgated that all terminals would install water-to-water heat exchangers of the shell and tube type to insure a closed circuit through the tube bundle for the high temperature water. It was also decided to call for throttling type control valves on the return HTHW lines from the exchangers. In this way, leaving temperature in secondary circuits would control throttling valves so that a minimum of primary water would flow as required. This principle was applied to all transfers of heat for use in the terminals and included snow melting systems for ramps.

Various Uses of Heat Transfer Equipment

Schematic sketches indicated the various uses that were made of the heat transfer equipment and the final uses of the secondary heat sources. In some instances, domestic hot water is heated by direct exchange from the HTHW and special safeties were required to prevent injury in the event of tube rupture.

The secondary uses were controlled in varying manners. Depending on the final design requirements for temperature and humidity and the ranges involved, direct throttling valves, three-way valves and mixing valves were used to achieve the desired results.

Within machine rooms in each of the terminals, the basic heat exchangers and control equipment were installed. In most cases, these basic rooms were limited to a single room. The exceptions, for the terminals constructed or in process of construction, are the International Arrival and Airline Wing Buildings and American Airlines, each of which had two basic machine rooms. There are, additionally, in each terminal, several utility rooms and fan rooms to house the various fans and basic units for air conditioning systems, ventilating systems, heating systems and control centers. The primary HTHW was confined to the basic machine rooms and the secondary system pumps, also within these rooms, pump intermediate or low temperature or other secondary fluid to the utility rooms for final use. In the snow melting systems, the secondary fluid was pumped to the snow melting grids in the ramp roads. Steam generators and condensate equipment also are located in the machine rooms.

Chilled Water Used In Terminals

The chilled water circulated to the terminals from the central plant is used only for space cooling. Cost of producing the chilled water will not permit its

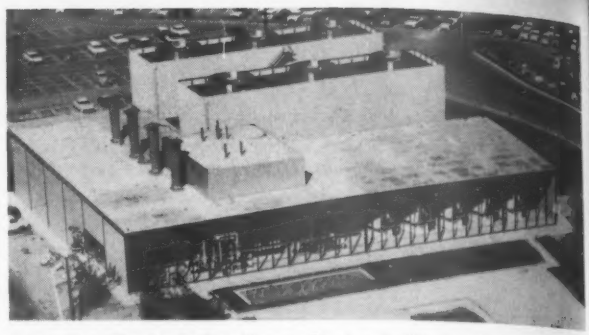


Fig. 5: *Central heating plant at New York's Idlewild Airport furnishes chilled water and high temperature hot water to all major buildings at airport.*

circulation to the terminals unless heat can be absorbed, in every gallon pumped, to produce cooling of space.

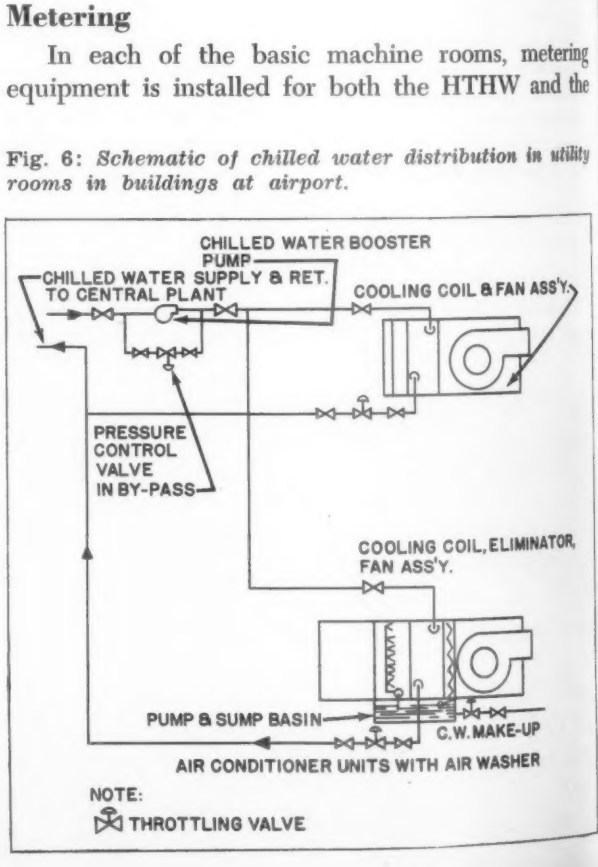
The policy has, therefore, been set up that all control valves used in any system of air conditioning should be of the throttling type. In this way only chilled water that is producing cooling is allowed to flow in the transmission lines between the central plant and the using terminals.

A further policy was adopted permitting the use of chilled water in closed circuit only. In all air conditioning systems, the water must go through a closed circuit cooling coil. Where the conditioning unit uses an air washer, the spray water is a completely separate circulating system. The chilled water throughout the terminal area is carefully treated and every effort is made to prevent any contamination by only allowing its use in a closed circuit unit.

Metering

In each of the basic machine rooms, metering equipment is installed for both the HTHW and the

Fig. 6: *Schematic of chilled water distribution in utility rooms in buildings at airport.*


CHILLED WATER BOOSTER PUMP
CHILLED WATER SUPPLY & RET. TO CENTRAL PLANT
COOLING COIL & FAN ASS'Y.
PRESSURE CONTROL VALVE IN BY-PASS
COOLING COIL, ELIMINATOR, FAN ASS'Y.
PUMP & SUMP BASIN
C.W. MAKE-UP
AIR CONDITIONER UNITS WITH AIR WASHER
NOTE:
THROTTLING VALVE

chilled water supplied to each terminal. All of the buildings are equipped with integrating Btu meters for water supplies. These meters, of the orifice plate type, are equipped with integrating Btu totalizers of the direct reading type. They indicate flow rate, entering water temperature of the supply line and temperature differential between each supply and return line. Exceptions to this type meter are the chilled water and HTHW meters in the Port Authority Operations Building and a second HTHW meter in the second machine room in the American Airlines Terminal. These meters are in-line flow meters that register cumulative flow and flow rate. They also have a differential temperature indicator and an integrating Btu totalizer. Data is gathered from each meter on a weekly basis for the accounting records and for billing purposes, for the energy consumed.

Terminals

All of the new terminal buildings in the central Terminal City area can truly be called "Fabulous" in their own right. Architecturally and physically, they are magnificent structures. Each building was designed specifically to symbolize the airline it was built for and to give to each its own character and vigor. Imposing lines were built into the exterior and interior finishes and all are beautifully decorated.

Each of the terminals has many thousands of square feet of usable and active space. There are many offices, waiting rooms for incoming and departing passengers, flight and operating rooms and offices, lounges for ladies and gentlemen, retail shops, baggage rooms, coffee shops and restaurants, cargo handling areas, service areas, corridors and vestibules. Each area is treated to give a feeling of spaciousness. Generally, ceilings are high where possible and areas and left unimpeded to give the impression of vastness, which isn't always necessary, particularly where the areas are physically large. Each terminal uses tremendous glass areas in its exterior treatment for light and to allow for visibility of the airfield over great areas.

Heat loads and cooling loads indicated previously for each building are a measure of the overall size of each. To provide all of the necessary heating and cooling systems for each terminal is a very complex problem. No single system or type system can take care of all the far flung units in each complex and the need of adequate systems to provide comfort under a variety of conditions. It would be a tremendous task to attempt to go into detail of the complexity of the systems in each building and it is beyond the immediate scope of this article.

In the paragraphs below, each of the buildings already constructed or in the process of construction will be described generally as to the various heating, ventilating and air conditioning systems employed and the areas they serve.

The Arrivals Building, through which all incoming overseas passengers must pass, houses all of the Federal, Health, Customs and Immigration offices and baggage handling space. It also contains a tremendous main concourse and various ticket offices and retail shops and other services and has large corridors and observation decks.

At exterior walls, direct hot water fin tube radiation is installed to take care of exterior wall losses. Outdoor thermostats, through pneumatic controls and submaster relay, regulate hot water temperatures to radiators and stop flow at appropriate upper temperature limit.

There are 22 air conditioning systems serving the building. These are complete with supply and return blowers, 45F to 55F chilled water cooling coils and air washers, 210F to 190F hot water reheat coils and electrostatic air filters. Systems serving exterior zones are of the dual duct type. All interior zone systems are of the conventional type.

The air conditioning units for the dual duct systems range from 5,000 cfm to 25,000 cfm at 5 in. to 6 in. w.g. and outlet velocities around 3400 fpm. Conventional systems, under 2000 fpm, distribute air at 3 in. w.g. Chilled water flows through coils range to 250 gpm and hot water flow through coils up to 100 gpm.

The air conditioning units are in utility rooms located in several spaces in the building and furnish conditioned air through each system to a particular zone. All air systems are controlled by a pneumatic control system. Extensive use is made of square, round and line diffusers, registers and grilles of all types for both exhaust and supply throughout all systems. Relief grilles are used to permit excess air to escape to corridors and vestibules from otherwise

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Fig. 7: *This dramatic night view shows close-up of absorption air conditioning equipment at Idlewild's central power plant. Photo courtesy Carrier Corp.*

Fig. 8: *Interior view, United Airline's new passenger terminal building at Idlewild. This view shows dropped lighting-acoustical ceiling with air diffuser outlet.*

(Continued from preceding page)

closed spaces. The conditioned spaces are designed for 78F and 50 percent relative humidity when outside conditions are 95F and 75F wet bulb.

Since the main air conditioning units are in the large basic machine and utility rooms, these areas are treated as fresh air plenums. On the outside walls of these rooms, louvers and preheat coils are installed to permit preheating the fresh air if necessary. The air conditioning units mix outside air and return air in automatically proportioned quantities, depending on season and requirements of conditioned area.

Corridors and large vestibules are heated and ventilated by air handling units located in the ceiling of the areas. Normally used as a ventilating unit, the air handling unit also supplies heat as required during the winter season.

The dining areas of all restaurants are air conditioned through several air conditioning systems. Kitchen make up and exhaust air is furnished through separate systems for each kitchen. All exhaust systems for kitchen hoods are completely separate.

Air supply and exhaust for toilet rooms, trash rooms, cargo areas and special service areas were also provided through separate systems.

Wing Buildings are occupied by 22 foreign flag air lines in completely separate units. Each air line rented a specific space and then proceeded to do all the construction work, attractively decorate it, and provide all furnishings. Included were the necessary air conditioning systems for each space.

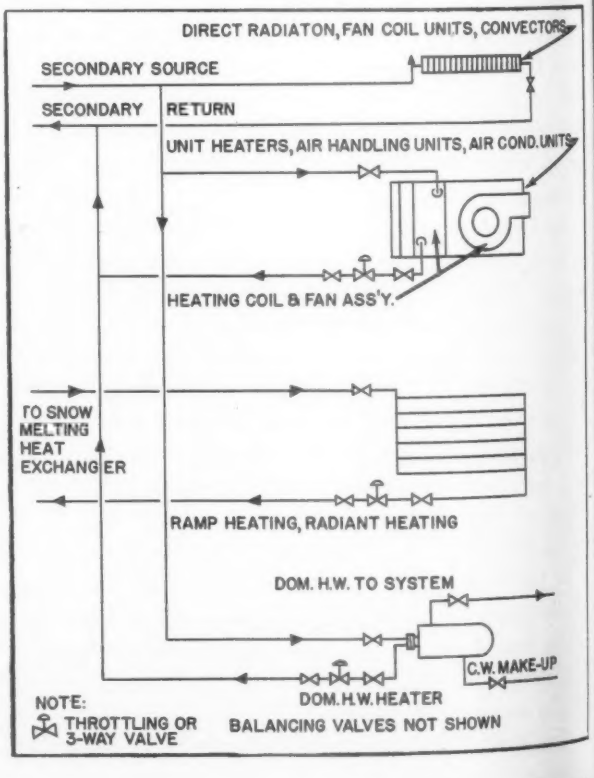
Various architects and engineers were retained by the airlines to do their work. All of the air conditioning systems are of conventional and, depending on space, range in size to a maximum of just over 100 tons for the largest area. The chilled water at 45F and secondary hot water at 210F was made available to the airlines at strategic points and the necessary piping connections for each area were made at the nearest available source.

The type of system and its operation in the space was the choice of the airline and its consultant. The only Port Authority concern was compliance with safety and building codes, proper service connections and restriction on use of flow control valves to throttling valves.

Along exterior walls of the airline tenant areas in the Wing Buildings, direct fin type hot water radiation was installed with the original building construction. With some modifications, where necessary, the units are being used by all tenants. Each has the same pneumatic control operation, using outdoor thermostat and submaster control to regulate water temperatures to the areas.

The 11-story Control Tower, as originally constructed, was only completed for occupancy on the upper five floors. Heating and air conditioning was provided by installing a temporary steam boiler and a cooling tower at grade level. A special machine room was established at the seventh floor level and equipped with a direct expansion water chiller, reciprocating compressor, pumps, an air handling unit, chilled water coils and a steam coil for preheating. Duct work took conditioned air, during all seasons, to the occupied areas including the Control Tower cab. Perimeter radiation was used in combination with the air system at all floors except the control cab where a steam booster coil in the line furnished additional heat and control.

Fig. 9: *Schematic drawing showing use of secondary hot water in building at Idlewild. Note use of heat exchanger for ramp heating.*



When the remaining floors were enclosed recently, the steam boiler and cooling tower were removed. A low pressure steam generator and domestic hot water generators and their auxiliary equipment and controls were installed in a basic machine room at grade level at the base of the tower. These heat exchangers were connected to HTHW supply and return lines from the service brought into the Arrivals Building. These lines, along with chilled water supply and return and other utilities, were brought into the Control Tower machine room through an underground pipe gallery between the International Arrivals Building and the Control Tower.

In the new machine room air conditioning units to serve the first six floors were erected and conventional duct systems installed. Ceiling diffusers, return registers and grilles were used on each floor.

A new steam riser and condensate return riser were installed in the pipe shaft. Fin tube steam radiators were installed around the glass enclosed perimeter on the new lower floors, similar to the existing system on the upper floors, and the radiators on all floors connected to the new risers.

Chilled Water Supply, Return

The chilled water supply and return lines were connected to the chilled water coils of the air conditioning units in the ground floor machine room. At the same time, chilled water supply and return risers were also installed to the 7th floor machine room. The reciprocating compressor and its auxiliary equipment were removed and the chilled water supply and return were connected into the chilled water system of the existing air conditioning unit. The steam preheat coil of the 7th floor air conditioning unit was also connected to the new steam and condensate risers from the ground floor machine room.

The air conditioning units on grade level machine rooms have steam coils for a capacity of 85 MBH and 85 MBH, chilled water cooling coils of 86 gpm and 118 gpm and air capacities of 11,000 cfm and 16,000 cfm at 2 in. and 3 in. w.g.

The control system for equipment and for local room temperatures is of the pneumatic type.

In all of the machine rooms and utility rooms throughout the International Arrivals Building, the Wing Buildings and the Control Tower, vibration eliminators and rails were installed as needed on all equipment to eliminate transfer of vibration and sound to the structure.

All air conditioning ductwork through the building was insulated with fiberglass incorporating a moisture barrier on the exterior surface to prevent condensation when carrying cool air. Air handling ducts for ventilation and heating service also were covered to prevent heat transfer losses, particularly in hung ceilings and in areas where it was undesirable to affect heat transfer. In the discharge ducts of fans and blowers, interior duct insulation for several feet

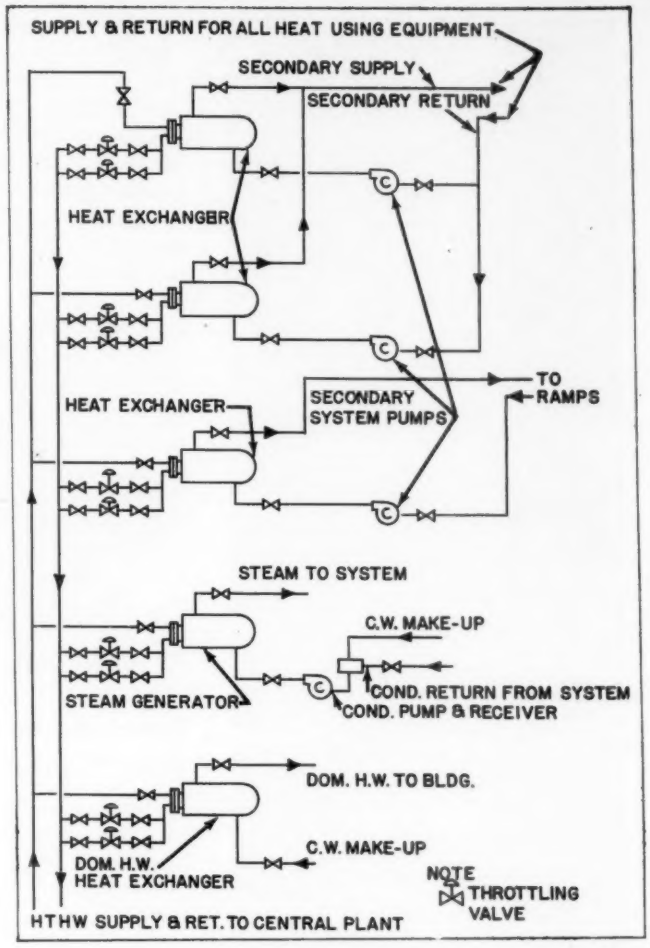
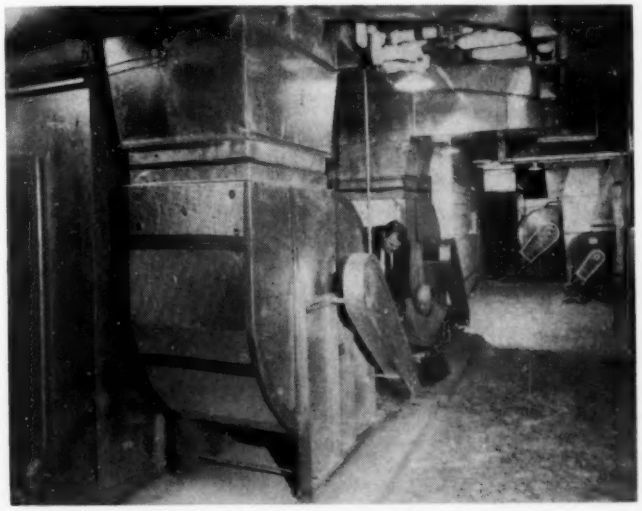


Fig. 10: *Schematic drawing showing heat source layout for utility rooms in buildings at Idlewild.*

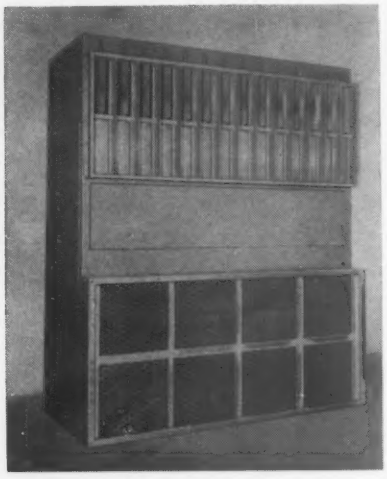
in length was installed to eliminate or minimize blower or fan discharge noises. In dual duct systems, attenuating boxes and attenuating P.R. V. and mixing boxes were used. Where possible, air noises due to any reason were minimized or eliminated.

Next month, details on the heating, air handling and air conditioning installations in each of the existing airline terminal buildings. ▲▲

Fig. 11: *Air handling equipment in United Airline's new passenger terminal building at Idlewild. HTHW and chilled water are metered from central plant.*



New PRODUCTS



Packaged Multi-Zone Air Conditioner

Purpose: Provide comfort conditioning in large open areas or several zones where excessive heat load presents a special problem.

Features: Available in 25, 30, and 40-ton capacities; nominal air handling capacities are 10,200, 12,600, and 17,100 cfm respectively. Quiet operation for combination heating-cooling requirements. Can be purchased as either single zone or multi-zone unit. Have top horizontal or up-blast discharge.

Source: American-Standard Industrial Div., Dept. AE, Detroit 32, Mich.

High-Capacity Power Roof Ventilator

Purpose: For use in high-capacity duct and flue exhaust applications.

Features: Ventilators are constructed of heavy-gauge spun aluminum, with weather-tight housing and steel base. Fan motor is direct-connected which eliminates belt maintenance and friction loss due to belt slippage. Capacity range of these L-CRF units is from 11,000 to 29,790 cfm.

Source: Ilg Electric Ventilating Co., Dept. AE, 2850 N. Pulaski Rd., Chicago 41.

Winter Controls for Air-Cooled Condenser

Purpose: To regulate system head pressures during low ambient periods, preventing pressure from dropping below any desired minimum.

Features: Wintermatic control system for use with Recold Dri-Con air cooled condensers consists of adjustable control valve and balancing valve. One adjusts to maintain minimum desired head pressure. When pressure drops below this, balancing valve opens and by-passes gas around condenser.

Controls may be installed anywhere in system. No additional

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has special Hemmed Edges for strength and safe, easy handling. No cuts! No scratches! No filter surface damage.

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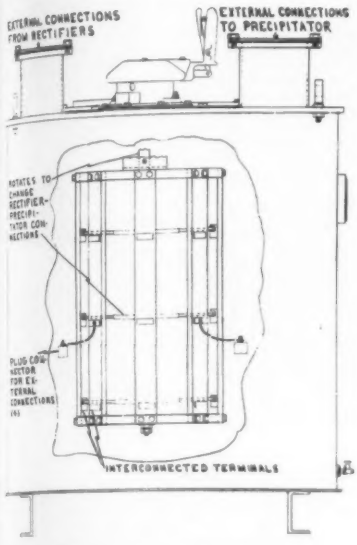
loops or traps needed. Can be used for multiple circuiting.

Source: Recold Corp., Dept. AE, 7250 East Slauson Ave., Los Angeles 22.


EXTERNAL CONNECTIONS FROM RECTIFIERS
EXTERNAL CONNECTIONS TO PRECIPITATOR
ROTATES TO CHANGE RECTIFIER-PRECIPITATOR CONNECTIONS
PLUG CONNECTOR FOR EXTERNAL CONNECTIONS (6)
INTERCONNECTED TERMINALS

High Voltage Switch for Electrostatic Precipitators

Purpose: For distributing power from rectifiers to electrodes of electrostatic precipitators. May be used with other types of high voltage-low current equipment.

Features: Totally enclosed switch is multi-deck rotary type designed to operate in all types of insulating oils. Housed in own compartment, it occupies about 1 cu. yd. of space. When immersed with transformer-rectifier, add 2 ft. to case.

Engineered for 100,000 volts and 1 amp. Switch action is of double blade type. Can be operated under load if necessary.

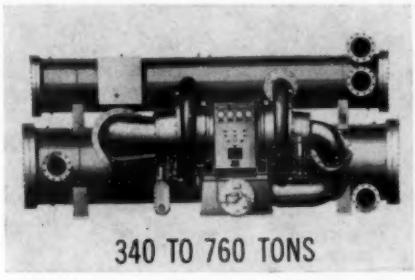
Source: Buell Engineering Co., Dept. AE, 123 William St., New York City.

Medium Metal Worker

Purpose: For use in engineering and research and development departments and for short run production of air conditioning, heating, and ventilating equipment.

Features: This sheet and plate working machine has edge-cutting capacity in mild steel of 15/64 in. Throat capacity is 43 in. Tooling available for straight, circle, figure, and slot cutting, beading, folding, louvering, nibbling, planishing, and flanging. Swedish made.

Source: Homestrand Machine Tool Corp., Dept. AE, 392 West Putnam Ave., Greenwich, Conn.



CenTraVac Hermetic Chiller

Purpose: Broadened line allows 150 motor-compressor-shell combinations for any air conditioning or process cooling requirement.

Features: Lower over-all profile, reduced weight, fabricated water boxes, new instrument panel, and redesigned purge unit.

Source: The Trane Co., Dept. AE, La Crosse, Wis.

Econobloc Pumps

Purpose: Economical operation in air conditioning systems.

Features: Available in six sizes in fractional horsepower range. Deliver up 80 gpm. Heads to 110 ft. Reliable and replaceable mechanical seal. Compact design. Die cast aluminum bronze impellers with shell-molded casings.

Source: Worthington Corp., Dept. AE, Harrison, N. J.

Correction

Glass-protected smokestacks produced by A. O. Smith Corp. have the glass bonded to the steel stack under great heat. The glass is not "painted on" as stated on page 54 of the March 1960 issue of AIR ENGINEERING.

(Please turn to following page)

Call on Rhodia "Odor Engineering" to solve your malodor problems in plant or product

Rhodia Inc. is the world leader in industrial odor control and reodorization technology and a primary producer of industrial aromatic chemicals. It offers fully qualified consultation service anywhere in the United States without cost or obligation.

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Please send me Rhodia literature.
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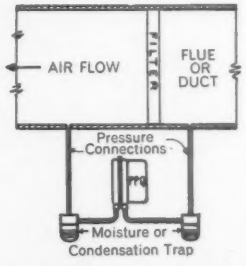
IS THIS YOUR
FILTER
CONTROL
PROBLEM?

1. *To indicate a change in resistance through a filter due to a clogging of the filter.*
2. *To indicate a change in differential across an orifice due to a change in air flow conditions.*

HERE'S THE SOLUTION

Specify a Mercoid Type PPQ Differential Pressure Control. Available with a sp-st mercury switch to operate from the difference in two pressures, or with two sp-st mercury switches, with one switch operating due to an increase in pressure difference and one switch operating due to a decrease in difference.



Illustrated above is a standard application whereby the Type PPQ functions to open (or close) an electrical circuit from a variation in pressure differential due to a clogging filter.

This control can also be used to indicate an unbalanced condition of two air ducts.

RANGES AVAILABLE

Control Range	Switch Range Operating Difference Adjustable Between
INCHES OF WATER	
6.0" Vac. to 6.0" Press.	0.03" to 2.0"
30.0" Vac. to 30.0" Press.	0.2" to 12.0"

Write for Bulletin CA-3P

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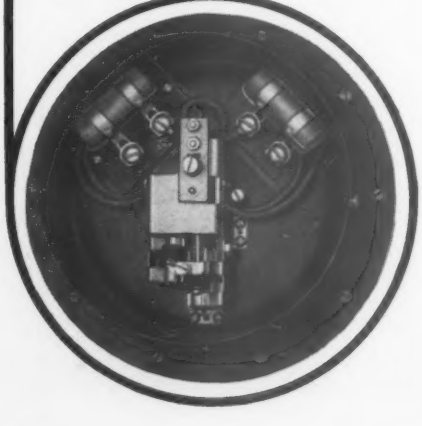
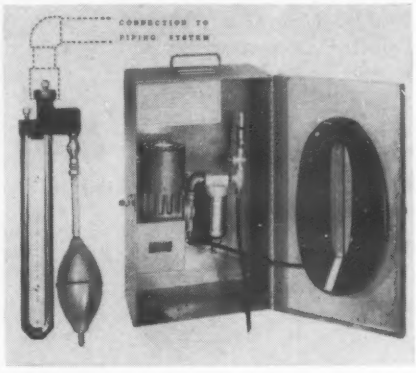


New PRODUCTS

(Continued from preceding page)

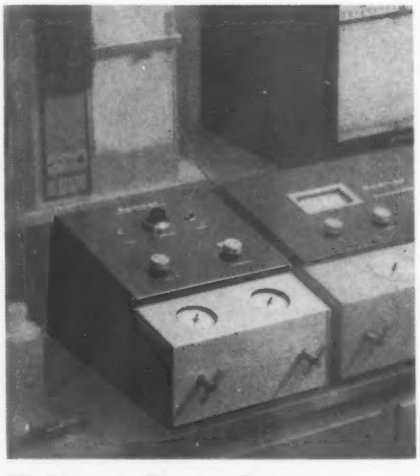


De-Tekta-Leak

Purpose: Check for leaks in gas piping, refrigeration, and other systems.

Features: Consists of U-tube manometer with connecting fittings and rubber bulb or small power-driven pump to build up pressure in system. Leaktight shutoff cock seals off system after it is pumped up. Loss of pressure indicates leak.

Source: Eclipse Fuel Engineering Co., Dept. AE, 1100 Buchanan St., Rockford, Ill.



Hydrogen Flame Detector

Purpose: For detecting minute traces in complex organic compounds. An accessory designed to supplement the standard thermal conductivity detector used in the Beckman GC-2 gas chromatograph.

Features: Has a typical sensitivity of 50 parts per billion full scale. Manufacturer claims it will produce signals over 10,000 times greater than conventional thermal conductivity cell.

Ultrasensitivity and high speed response permits operation with small sample volumes. Assembly includes electrometer, burner assembly, flow controls, mounting bracket, and instructions.

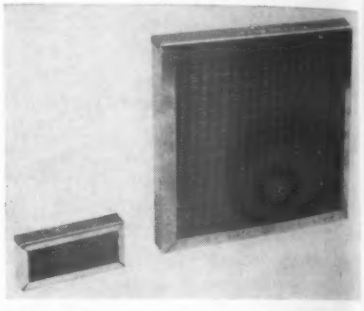
Source: Beckman Scientific and Process Instruments Div., Beckman Instruments, Inc., Dept. AE, 2500 Fullerton Road, Fullerton, Calif.

Special Safety Garment

Purpose: To be worn when handling liquid oxygen.

Features: Made of vinyl-coated glass cloth. Offers complete coverage for head and body. Opens down back. Hood can be slipped forward when not in use.

Source: M. Setlow & Son, Inc., Dept. AE, 131 Chestnut St., New Haven, Conn.

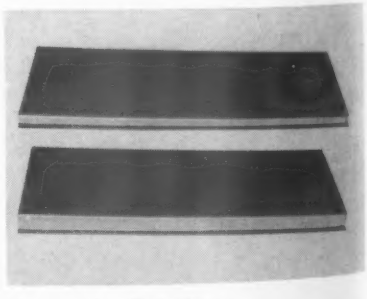


Air Filters

Purpose: To protect miniaturized, ventilated electronic equipment.

Features: Made in any rectangular size and any thickness from ½ to 4 in. Available in aluminum, steel, bronze, and stainless steel. Internal media of Airsan Type V-10 filters retains constant density. Not affected by climatic or temperature changes.

Source: Air Filter Corp., Dept. AE, 4554-B W. Woolworth Ave., Milwaukee 18, Wis.



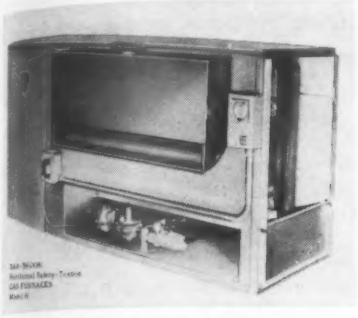
Acoustic Panels

Purpose: Use as sound barriers and partial enclosures for control of noise in industrial plants and offices.

Features: Rugged construction with special connecting joints for

noise reduction. Available in cold rolled steel, galvanized steel, stainless steel, or other materials.

Source: Industrial Acoustics Co., Inc., Dept. AE, 341 Jackson Ave., New York City 54.



Horizontal Gas-Fired Furnace

Purpose: To fit in small places in industrial plants and commercial applications.

Features: Available in four models ranging from 60,000 to 120,000 Btuh. Shipped completely assembled in insulated steel cabinet. All controls automatic and easily accessible.

Source: Bar-Brook Mfg. Co., Inc., Dept. AE, 6135 Linwood Ave., Shreveport, La.

Air Velocity Meter

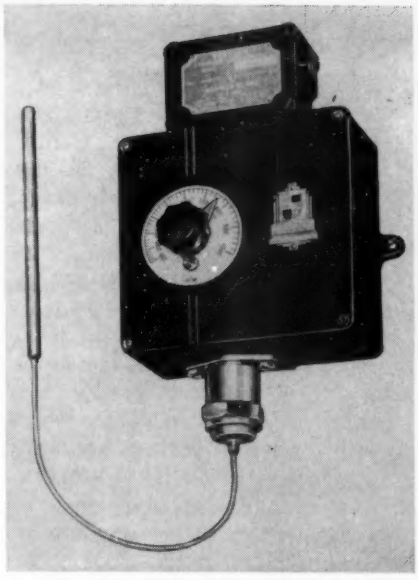
Purpose: Accurately measure air speeds from 0.05 ft./sec. to 30 ft./sec. and air temperatures in 30 to 110F and 50 to 250F ranges.

Features: Thermo - anemometer is composed of a directly calibrated meter-power unit small enough to hold in use. Power supplied from flashlight battery.

Probe consists of small metal cylinder in which two resistance wires are mounted. One of wires is heated, other cold. Two elements are arranged in wheatstone bridge circuit so cooling effect is function of air velocity. Air temperatures can also be tested by flipping a switch.

Jointly developed by Gelman and Wallac Co. of Turku, Finland.

Source: Gelman Instrument Co., Dept. AE, 106 N. Main St., Chelsea, Mich.



Explosion-Proof Non-Indicating Control

Purpose: Temperature control for use in hazardous locations for heating or refrigeration applications.

Features: Model GVS temperature control incorporates, in a sealed enclosure, a snap-acting switch to control an electrical circuit actuating valves, solenoids, motors, heating elements, or other appliances. Temperature is sensed by mercury-filled thermal element placed in medium to be controlled.

May be used to sense and control temperatures from -30F to 1100F in a variety of 10 ranges.

Source: Partlow Corp., Dept. AE, 534 Campion Road, New Hartford, N. Y.

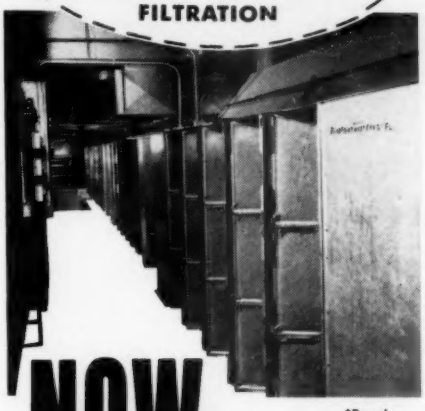
Circular Slide Rule

Purpose: Perform simple calculations in multiplication, division, and proportion.

Features: Pocket size, circular shape. Free to engineers, plant and office executives writing on company letterhead. Fifty cents to others.

Source: General Industrial Co., Dept. AE, 1788J Montrose Ave., Chicago 13, Ill.

NEW
Micromat®
SYSTEM OF AIR FILTRATION



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*Panel installation, McDonnell Aircraft

tailor air filters to job requirements ... economically

A *new concept* in air purification, MICROMAT offers not one but NINE separate and distinct filter media, each with certain capabilities. The MICROMAT System, with a medium to meet virtually any set of specifications for efficiency and air flow, provides the means of tailoring air filtration to your exact requirements.

Efficiency Range—5% to 85%
MICROMAT Replaceable Media are made from various types of non-woven synthetic fibers. Their natural filtering properties eliminate any need for viscous coating, yet MICROMAT media efficiencies range from 5% to 85% (using Discoloration Test procedures.)

Cut Maintenance Costs
MICROMAT filters normally afford appreciable savings in handling, changing, and storing when compared to permanent, washable type filters. Versatile in use, MICROMAT media are readily adaptable to panel (frame), blanket or roll machine installation.

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Present users have found that, at any given air velocity, the right MICROMAT medium will outperform conventional filters and deliver cleaner air at lower overall cost.

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determine
DUST PARTICLE
SIZE DISTRIBUTION
below 60 microns

Micro-Particle Classifier No. 6000 with totally enclosed 220 volt, 3 phase motor operates at 3500 rpm. 16" high x 16½" diameter

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MICRO-PARTICLE
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Quickly determine sub-sieve particle sizes with scientific accuracy. The No. 6000 Dietert-Detroit Micro-Particle Classifier is widely used throughout industry for pre-testing dust collector needs, for determining the separating efficiency of air cleaners, for particle size control in many industrial processes and for scientific studies of fine materials. Mineral flours, metal powders, abrasives, fly ash, chemicals, drugs, etc., can be classified into eight fractions below 60 microns, (materials above 60 microns can be retained for sieve analysis). An eight-fraction analysis can be completed at the rate of 15 minutes per fraction by unskilled operators. Fractions are precisely defined and may be retained for accurate study. Gentle sifting action prevents particle fracture—assures accuracy and reproducibility.

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Send me 8 page Micro-Particle Classifier bulletin—without obligation.

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CITY_____ STATE_____

BRI Seminar

(Continued from Page 26)

Dr. V. W. Greene, assistant professor, School of Public Health, University of Minnesota, in discussing how hospital air handling systems can help reduce airborne bacteria, stated:

"Just as we protect critical hospital areas from unwanted visitors by doors and barriers, so must we protect these areas from unwanted bacteria by planned airflow patterns. One must consider each hospital area and design the ventilation specifically for that area.

"For example, in a nursery or delivery room where uncontaminated air would be most desirable, the air pressure should be greater than that in the nearby hallways to minimize movement of contamination from the latter source.

"On the contrary, a similar system installed in an isolation ward might endanger everyone in the surrounding area by pushing pathogens from already infected patients out of the rooms into the hallways.

"Under special conditions, air lock arrangements might be used to maintain proper pressures and prevent movement of contaminated air into areas where it presents a hazard.

"The forces which influence airflow must also be considered in ventilation design. These institutions are literally honeycombed with chutes, stairwells, elevators, duct shafts, conduits and other pathways suitable for transport of microbe laden air. It is not sufficient to consider bacterial transport merely by studying floor plans—the over-all structure must be kept in mind.

"Also, a hospital ventilation system should be designed to *eliminate* these bacteria, rather than merely push them around. One way in which this can be accomplished is by ventilation providing 18-75 air changes per hour.

"More work should be devoted to arriving at a sound basis for optimum ventilation rates, however, before any general applicable values are accepted.

"It is possible on the basis of experimental trials to obtain counts consistently less than 1-2 bacteria per cu. ft. by treating incoming air with commercially available air cleaning systems, such as mechanical and adhesive filters, chemical germicides, ultraviolet radiation, and electronic air cleaners."

Louis C. McCabe, president, Resources Research, Inc., Washington, D. C., offered an index of pollutants which may be applied to most localities for evaluating amounts of air contaminants where controls are not present.

The index of six contaminants follows:

1. *Oxides of sulfur, estimated as SO_2, are emitted from:*
   a. Fuel oil combustion: about 30 lbs./100 lbs. oil.
   b. Coal burning: about 40 lbs./ton coal.
   c. Automobile engines: about 17 lbs./1000 gal. gasoline.
   d. Diesel engines: about 15 lbs./1000 gal. fuel.
2. *Oxides of nitrogen, estimated as NO_2, are produced from:*
   a. Fuel oil burning: about 13.5 lbs./1000 lbs. oil.
   b. Natural gas burning: about 6.9 lbs./1000 lbs. gas.
   c. Coal burning: 8 lbs./ton coal.
   d. Automobile engines: 25-75 lbs./1000 gal. gasoline.
   e. Diesel engines: 75 lbs./1000 gal. oil.
   f. Waste incineration: about 4 lbs./ton mixed refuse.
3. *Solids, as dusts, smoke, condensed fumes, etc., result from:*
   a. Waste incineration: at about 25 lbs./ton burned.
   b. Fuel oil combustion: about 2.5 lbs./1000 lbs. oil.
   c. Coal burning: around 200 lbs./ton fuel.
   d. Automobile engines: about 0.3 lbs./gal. gasoline.
   e. Diesel engines: about 100 lbs./1000 gal. oil.
4. *Aldehydes, estimated as formaldehyde, are emitted by:*
   a. Automobile engines: about 18 lbs./1000 gal. gasoline.
   b. Diesel engines: 30 lbs./1000 gal. oil.
5. *Carbon monoxide is produced from gasoline engines* in normal operation at about 3200 lbs./1000 gal. of gasoline. This is the only really significant source of CO, with the possible exception of improper household heating.
6. *Organic vapors, often referred to as "hydrocarbons," are emitted as pollutants from:*
   a. Automobile engines: average rate of 200-400 lbs./1000 gal. gasoline.
   b. Evaporative losses from automobile carburetors and tanks at a highly variable rate with air temperature: at 100F the loss may be 2.5 to 5.0 percent of the gasoline throughput.
   c. Evaporation losses from the use of organic paint and lacquer thinners, dilutents, solvents, degreasing agents, cleaning compounds, and the like can be assumed to equal the amount used.
   d. Evaporation of gasoline during storage, handling, and marketing is estimated at about 100 lbs./1000 gal.

Balancing Techniques

(Continued from page 39)

to maintain either designed temperature rise on the air side in accordance with the manufacturer's data, or the temperature drop across the water side, in accordance with the initial design. Or water flow may be set to conform to a specific pressure drop across the coil, when necessary to conform to such pressure drops for other components of the water system.

Duct hot or chilled water coils can be balanced to attain the required air Btu if the air flow is known, which is the method most economical of piping sizes and pump heads. Or coils may be adjusted to a specified temperature differential on the water side, which is the most economical method from the point of view of field labor.

Coils can also be adjusted to attain a desired flow by control of pressure drop across the coil on the water side, as this pressure drop is a function of flow through the coil, and is data normally included on shop drawings. The coil vent drain connections furnish a convenient location for measurement of these pressures.

Next month, the final article in this series will discuss corrective measures that can be taken after attempts at system balancing fail to provide comfort conditions as specified or provided for in the design. ▲▲

Controlling Airborne Bacteria

(Continued from page 45)

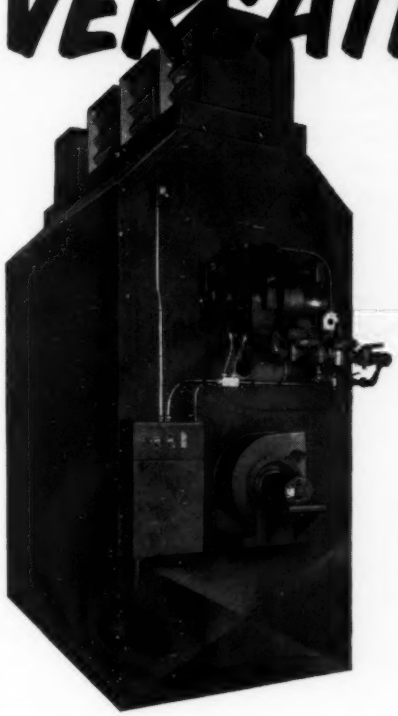
enforcing sanitary standards of air inside hospitals must, of necessity, rest with the hospital administrator and his senior surgeons and physicians. However, their decisions may be based solely on their estimate of the importance of air cleanliness since means are readily available to prepare and distribute sterile, dust-free, odor-free air at constant temperature and humidity in sufficient volumes to reduce air bacteria by dilution. ▲▲

REFERENCES

10. Allan, H. F., "Air Hygiene for Hospitals". JAMA 169:553 and 170:261 (1959)
11. Decker, H. M., et al, "Filtration of Microorganisms from Air by Glass Fiber Media". Heat., Piping, Air Cond., 26:155 (1954)

Use the addressed, postage paid cards in the Communications Center, page 47, for more information on new products, your comments about editorial material in this issue, suggestions for topics to be covered editorially, etc.

J-C Today's most VERSATILE direct-fired unit heater



Model JC-200 2,000,000 Btuh output. Oil, gas or dual fuel.

Floor-mounted, horizontal, or inverted, this quality-built, factory-assembled, and fire-tested Jackson & Church direct-fired unit heater is proving ideal for hundreds of large-area heating jobs. Stainless steel, airfoil design combustion chamber eliminates refractory linings. Saves money on installation and maintenance. Available in outputs from 400,000 to 2,000,000 Btuh. Up-date your files with current specs. Write today.

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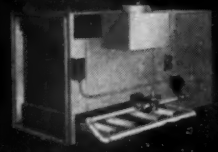
12 Oil-fired Suspended models 123,000 to 1,000,000 Btuh output.



11 Gas-fired Suspended models 160,000 to 320,000 Btuh output.

12 Powerated Tubular models 208,000 to 320,000 Btuh output—Oil, gas or dual fuel.

37 Powerated Tubular models 400,000 to 3,800,000 Btuh output—Oil, gas, dual fuel, or stoker firing.

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Pioneers and Specialists in Automatic Heat. Boilers to 600 hp. Furnaces to 4,750,000 Btuh

? ? ? ? ? ? ? Questions & ANSWERS ? ? ? ? ? ? ?

QUESTION:

"Threshold Limit Values" were adopted by the American Conference of Governmental Industrial Hygienists at their 21st Annual Meeting. Can you explain what significant changes were made?

S.F.T.
Yonkers, N. Y.

ANSWER:

The following changes were made in the Threshold Limit Values for 1959:

	—1958 Values—		—1959 Values—	
	PPM	Mg/M³	PPM	Mg/M³
Chloroform	100	490	50	240
Bromine	1.	7.	0.1	0.7
Chloropicrin	1.	7.	0.1	0.7

The reduction in the value for chloroform is on the basis of the results of a study of industrial chloroform exposures recently published in the *British Journal of Industrial Medicine* by Challen, Hickish and Redford.

The reduction in Threshold Limit Values for bromine and chloropricrin is the result of a careful review of data which has been in literature for a longer period.

The following substances have been added to the recommended Threshold Limit Values from the tentative values. They have been on the tentative list since 1957.

Gases Vapors	*PPM*	*Approx. Mg. per Cu. M.*
Acetylene-Tetrabromide	1	14
Methyl Stryrene	100	480
Monomethyl aniline	2	9
Paradichlorobenzene	75	450
Propylene Oxide	100	240
Tertiary Butyl alcohol	100	300
Tolylene-2, 4-diisocyanate	0.1	0.7
Triethylamine	25	100
Vinyl toluene	100	480
Xylidine	5	25
Fume Toxic Dusts		
Berylium		.002

Threshold Limit Values, Maximum allowable concentrations (MAC's) and Hygienic Standards

The above three terms are used to designate limit values to be used as guides for the control of health hazards. The source of these terms is as follows:

Maximum Allowable Concentration (MAC) is the term used by the American Standards Association. They established the first limit values recommended by an association or official agency. The American Standards Association antedated the Threshold Limit

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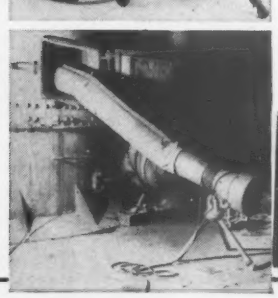

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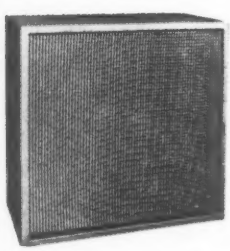

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Values of the American Conference of Governmental Industrial Hygienists by a number of years. However, the number of MAC values published are comparatively few in number. In recent years this association has not been too active in establishing MAC's.

Threshold Limit Values are recommended guide values of the American Conference of Governmental Industrial Hygienists. This list is annually revised, enlarged and brought up to date. It is the recognized authority in the industrial health field. The term "threshold limit" is adopted because it is more inclusive than "Mac's" as it can be used for noise and radiation exposures.

Hygienic Standards is the term used for threshold limits by the American Industrial Hygiene Association in their *Hygienic Guide Series.* These Guides are published in loose leaf form, each guide gives pertinent data on one particular substance. The guides give physical properties, chemical data, threshold limits and symptoms of toxic exposure. These hygienic standards are always in agreement with the "Threshold Limits" of the American Conference of Governmental Industrial Hygienists. They however, may mention values from medical studies, experimental data, etc.

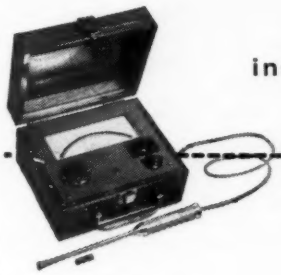
Use of Threshold Limits

Threshold Limit Values must be used cautiously by inexperienced untrained personnel. The understanding of the background behind the selection of each limit is necessary to correctly apply the threshold value, for example, values for lead, benzine, and carbon tetrachloride have almost no safety factor and when exceeded may cause occupational disease and chronic health impairment. On the other hand values for sulfuric acid and hydrogen chloride are set not on the basis of permanent health damage but on the basis of eye, nose and throat irritation. Other material such as gasoline produce intoxication and grogginess above the threshold limit but not necessarily permanent health damage.

Other factors which need to be evaluated and understood in applying threshold limits are the effects of low pressures (high altitudes), and high pressures, (caisson, high pressure tunneling work, etc.). The threshold limits established at normal pressures are not applicable without modification under some of these conditions.

The effect of the exposure of several substances at once often causes synergistic effects that may require modification of the threshold limits. This is difficult to evaluate, even by experienced personnel.

Also, although it is implied that limits are "average concentrations" for a normal work day, with many substances, short duration and high exposure together with very low exposures which may give an average exposure below the threshold limit, may give adverse effects. The variance to be allowed above the threshold limit average concentration needs the judgment of a trained, experienced industrial hygienist.



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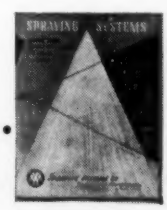

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